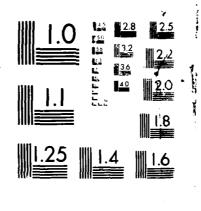
COMPLIANCE TESTING OF GRISSON AFB CENTRAL HEATING PLANT COAL-FIRED BOILER. (U) AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LAB BROOKS AF. J A GARRISON MAR 88 USAFOEHL-88-050E00023CEF F/G 13/1 AD-8195 220 1/2 **UNCLASSIFIED**



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USAFOEHL REPORT

88-050EQ0025CEF



Compliance Testing of Grissom AFB Central Heating Plant Coal-Fired Boilers 3 and 4, Grissom AFB IN

JAMES A. GARRISON, Maj, USAF, BSC

March 1988

Final Report



Distribution is unlimited; approved for public release

USAF Occupational and Environmental Health Laboratory
Human Systems Division (AFSC)
Brooks Air Force Base, Texas 78235-5501

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This report has been reviewed and is approved for publication.

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I. INTRODUCTION

On 18-23 Nov 37, a stationary source sampling survey for particulate emissions was conducted on coal-fired boilers 3 and 4 at the Grissom AFB Central Heating Plant, by the Air Quality Function of the USAF Occupational and Environmental Health Laboratory (USAFOEHL). This survey was requested by HQ SAC/SGPB to determine particulate emission compliance status with regards to Indiana Administrative Code, Title 325 - Air Pollution Control Board, Article 5, Opacity Regulations (325 IAC 5), and Article 6, Particulate Regulations (325 IAC 6). Personnel involved with on-site testing are listed in Appendix A.

II. DISCUSSION

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A. Background

On 7 Nov 1986, the Director, Air and Radiation Division, U.S. Environmental Protection Agency (EPA), Region V, issued a notice of violation (NOV) to Grissom AFB for violation of 325 IAC 5, Opacity Regulations. The NOV was based on information submitted by the State of Indiana Department of Environmental Management and by the EPA. Observations indicated that boilers 3 and 4 and oil-fired boiler 1 were out of compliance with respect to visible emissions.

To demonstrate and maintain compliance with 325 IAC 5 and other rules set forth by the Indiana Air Pollution Control Board, EPA, Region V required Grissom AFB to: (1) conduct stack particulate emission testing on boilers 3 and 4 as specified in Title 40, Code of Federal Regulations, Part 60(40 CFR 60), Appendix A, Reference Method 5, (2) determine visible emissions from boilers 1-4 as specified in 40 CFR 60, Appendix A, Reference Method 9 and (3) request stack testing following future major modifications to the central heating plant.

B. Site Description

The Central Heating Plant operates a total of five boilers for steam production:

		Steam Capacity		
Boiler No.	Manufacturer	lb/hr	Year Installed	Fuel
1	Springfield Boiler Co.	40,000	1955	oil
2	Springfield Boiler Co.	40.000	1955	oil
3	Springfield Boiler Co.	40,000	1955	coal
4	E. Keeler Co.	40,000	1960	coal
5	Zurn Ind.	65,000	1980	coal

Boilers 3 and 4 are spreader-stoker fired units with each having forced-draft and induced-draft fans and mechanical fly-ash collection systems. The purpose of the forced-draft fan is to supply air for combustion and that of the induced-draft fan is to maintain a negative draft condition in the furnace part of the boiler for combustion and removal of gases and to provide a positive static pressure at flue gas exhaust discharge points. The ash system pneumatically removes ash from bottom-ash hoppers, sifting hoppers and mechanical collector hoppers. Both units are fitted with a steam-operated soot blower to remove fly-ash and soot from heat exchanger tubing.

Air pollution control consists of individual cyclonic dust collectors on each boiler and a wet scrubber common to the three coal-fired boilers. The multiclone dust collector, Model 9VM-10, is manufactured by Western Precipitation Division - Joy Manufacturing Co. Each collector consists of 36 nine-inch diameter cyclonic collectors operating in parallel. The units are located in the boiler exhaust duct upstream of the induced-draft fan. Ash collected by the multiclones is carried by gravity to a hopper.

The exhaust effluent from each boiler is ducted to a common breeching and can be routed to the wet-scrubber or to a bypass stack. The scrubber is a double-alkali flue-gas desulfurization system using soda ash(sodium carbonate) in the scrubbing fluid and lime (calcium hydroxide) slurry for regeneration of the scrubbing liquid. The primary purpose of the unit is to remove sulfur from the flue gases; a secondary purpose is to remove particulates from the flue gases. The system has two identical scrubber units each designed to handle 50% of the flue gases from the three coal-fired boilers. Each unit has a 5 ft diameter stack and terminates about 70 feet above the ground. There is no requirement at this time to use the scrubber system because of the low-sulfur coal being used by the plant. The bypass stack has a 5.5 ft diameter and terminates approximately 70 ft above ground level. The scrubber stacks and the bypass stack can be seen in Figures 1, 2 and 3. A flue gas flow diagram is shown in Figure 4.

C. Applicable Standards

The monitoring requirements, opacity regulations and particulate regulations are defined under 325 IAC 3, 5 and 6 respectively. Article 5 states that visible emissions shall not exceed an average of 40% opacity in 24 consecutive readings or 60% opacity for more than a cumulative total of 15 minutes (60 readings) in a 6-hour period.

Under 325 IAC 6, the maximum allowable particulate emission rate from the combustion of fuel for indirect heating is determined by the following equation:

$$Pt = \frac{C \times a \times h}{0.75 \quad 0.25}$$

$$76.5 \times Q \times N$$

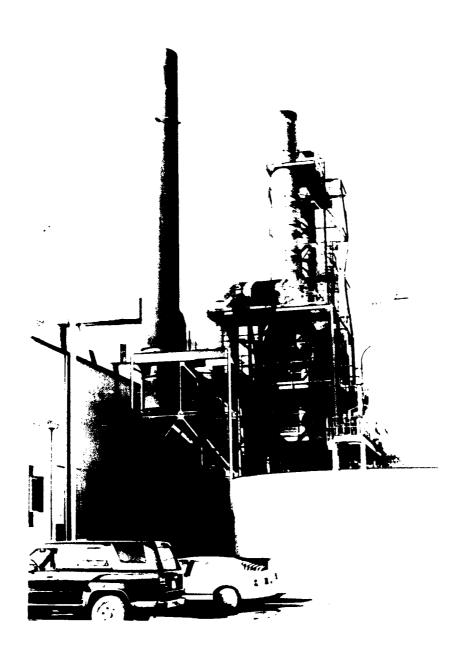
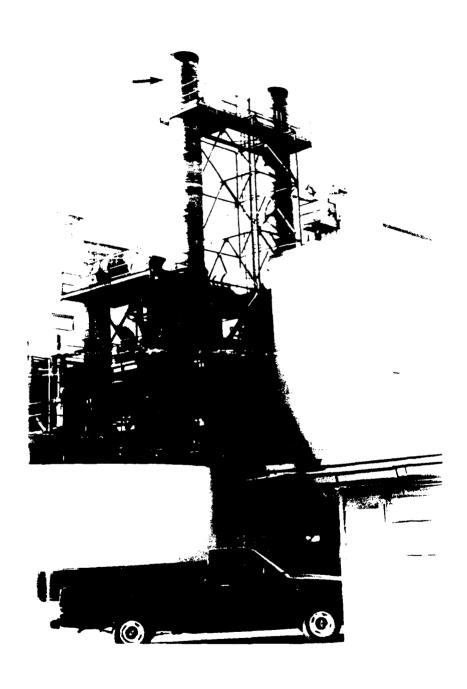
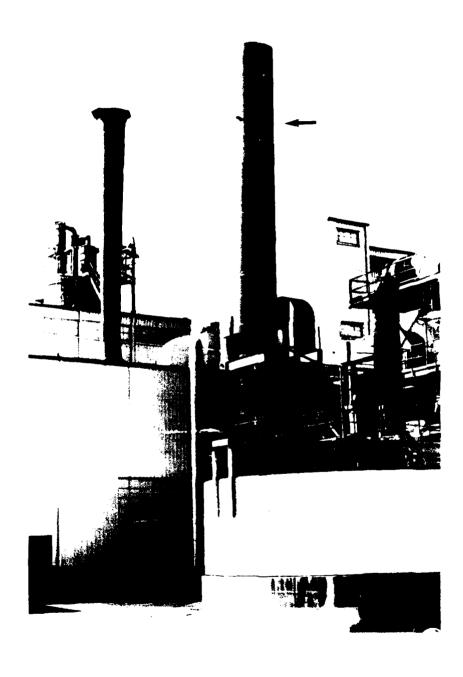


Figure 1. View of Bypass and Scrubber Stacks



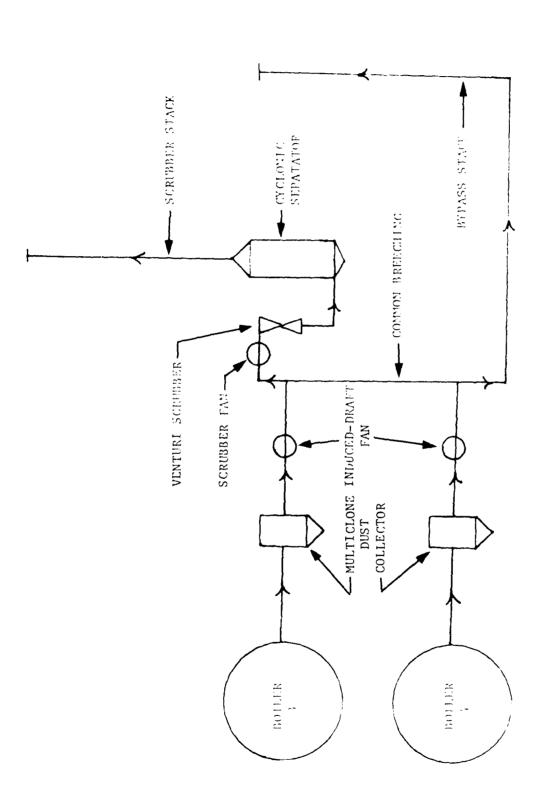
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Figure 2. Scrubber Stacks (Scrubber B noted by arrow)



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Figure 3. Bypass Stack (Noted by arrow)



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Figure 4. Flue Gas Flow Diagram

Where:

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- Pt = Pounds of particulate matter emitted per million Btu heat input (lb/mmBtu).
- C = Maximum ground level concentration with respect to distance from the point source at the "critical" wind speed for level terrain (50 micrograms per cubic meter-provided in standard).
- Q = Total source maximum operating capacity rating in million Btu per hour(mmBtu/hr) heat input (50.8 mmBtu/hr determined from plant operation).
- N = Number of stacks in fuel burning operation (1).
- a = Plume rise factor (0.67 used for Q less than or equal to 1,000 mmBtu/hr) heat input.
- h = Stack height in feet (70 ft).

The limit on particulate emissions determined by the above equation and values of the variables applicable to this facility is 1.6 lb/mmBtu. However, particulate emissions from facilities used for indirect heating purposes which were existing and in operation on or before June 8,1972, shall in no case exceed 0.8 lb/mmBtu heat input. State regulations are presented in Appendix B.

D. Sampling Methods and Procedures

Boilers 3 and 4 were tested through both the scrubber and bypass stacks. Only scrubber B was tested since we assumed that it mimicked the operation of scrubber A. Coordination was made with plant personnel to operate each boiler at 95% capacity or greater during testing. One of the three runs which comprised a complete test included a soot blow; this is indicated on the field data sheets. Boiler operating logs for the test periods are provided in Appendix C. These logs indicate hourly steam output and coal usage. Laboratory results for the coal analysis are provided in Appendix D. Each coal sample represents an integrated sample collected over a particular one hour test run as noted on the analysis sheet.

325 IAC 3 requires that all emissions tests be conducted in accordance with the procedures and analysis methods specified in 40 CFR 60, Appendix A, Methods 1-5. Therefore, test methods, equipment, sample train preparations, sampling and recovery, calibration requirements and quality assurance were done in accordance with the methods and procedures outlined in 40 CFR 60, Appendix A.

Inspection of the stacks indicated that sampling ports had already been installed on the scrubber stack and were located 1.4 stack diameters upstream from the stack exit and 5.6 stack diameters downstream from any disturbance (cyclonic separator). Based on a 5 ft inside stack diameter, port location and type of sample 'particulate), a total of twenty traverse points were determined for emission evaluation. Sampling ports had to be installed on the bypass stack and were located 2 stack diameters upstream from the stack exit and 7 stack diameters downstream from the nearest disturbance (common breeching inlet). Based on a 5.5 ft inside stack diameter, port location and type of sample (particulate), a total of twelve traverse points were determined for emission evaluation. The sampling time for each sampling run was 60 minutes; therefore, the sampling time for each point in the scrubber stack was 3 minutes and the time for each point in the bypass stack was 5 minutes. Illustrations showing port locations and sampling points are provided in Appendixes E - H.

Prior to every sample run on each stack, a preliminary velocity pressure traverse was accomplished and cyclonic flow was determined. For acceptable flow conditions to exist in a stack, the average of the absolute value of the flow angle taken at each traverse point must be less than or equal to 20 degrees. The flow angle in the bypass stack averaged 15-17 degrees which indicated an acceptable flow condition. Initially, the flow angle in the scrubber stack averaged 24 degrees. This was caused by the tangential entry of the flue gas into the cyclonic separator. Straightening vanes were installed directly above the cyclonic separator which brought the average flow angle to 9 degrees.

During each sample run, a flue gas sample for orsat analysis (measures oxygen, and carbon dioxide for stack gas molecular weight determination) was taken. Orsat sampling and analysis equipment are shown in Figures 5 and 6. Flue gas moisture content, also needed for determination of gas molecular weight, was obtained during particulate sampling.

Particulate samples were collected using the sampling train shown in Figure 7. The train consisted of a button-hook probe nozzle, heated inconel probe, heated glass filter, impingers and pumping and metering device. The nozzle was sized prior to each sample run so that the gas stream could be sampled isokinetically; in other words, the velocity at the nozzle tip was the same as the stack gas velocity at each point sampled. Flue gas velocity pressure was measured at the nozzle tip using a Type-S pitot tube connected to a ten inch inclined-verticle manometer. Type K thermocouples were used to measure flue gas as well as sampling train temperatures. The probe was heated to minimize moisture condensation. The heated filter was used to collect particulate materials. The impinger train(first, third and fourth impingers: modified Greenburg-Smith type, second impinger: standard Greenburg-Smith design) was used as a condenser to collect stack gas moisture. The pumping and metering system was used to control and monitor the sample gas flow rate.

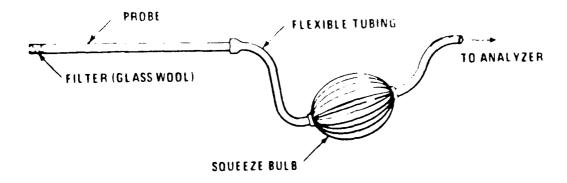
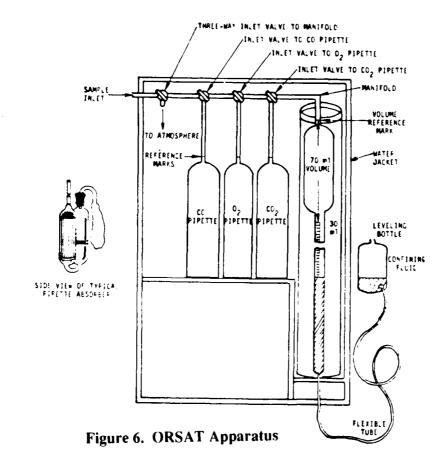
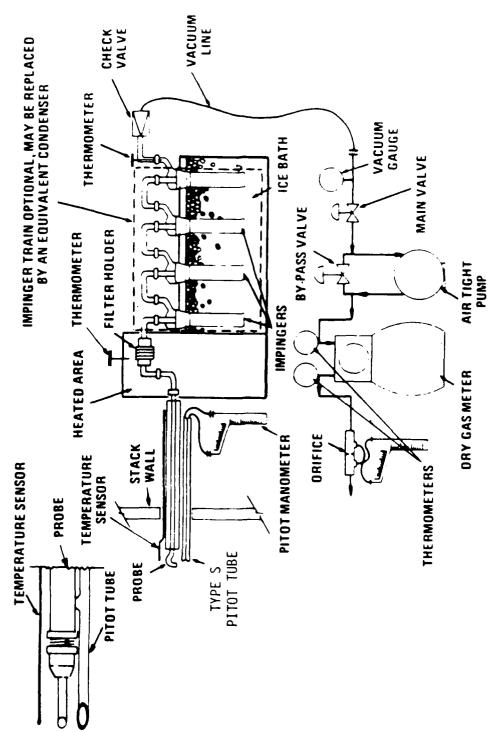


Figure 5. ORSAT Sampling Train





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Figure 7. Particulate Sampling Train

Emission calculations were done using two different computer packages. The first of these is entitled "Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators" (EPA-340/1-85-018) developed by the EPA's Office of Air Quality Planning and Standards, Research Triangle Park NC. This has been our standard method for calculating emission data. The second package is entitled "Stack-Pack" and was developed by Mr B.B. Booth, Shasta County Air Quality Management District, Redding CA. Stack-Pack is made for the minicomputer. Since Stack-Pack runs on the minicomputer and provides resultant calculations in a simple report format, we decided to use it for this project. First, however, it was compared to the EPA program for accuracy. We found it compared very favorably and was even slightly more conservative than the EPA programs. Therefore, calculations for this project were made with Stack-Pack. All sampling data and resulting calculations from the Stack-Pack program are presented in Appendixes E-H; calculations from the EPA programs are found in Appendix I. Calibration data is presented in Appendix J.

III. CONCLUSIONS

The following table provides operating parameters for boilers 3 and 4 during testing and the resultant particulate emission rates determined from these tests. Results indicate that boiler 3 and 4 emissions through the bypass stack were well below the emission standard of 0.80 lb/mmBtu with particulate emission rates of 0.32 lb/mmBtu and 0.48 lb/mmBtu respectively. Boiler 3 emissions through the scrubber were above the standard with an emission rate of 4.18 lb/mmBtu. Boiler 4 emissions through the scrubber were below the standard with an emission rate of 0.69 lb/mmBtu.

We believe a number of factors contributed to the high particulate loading experienced with boiler 3 scrubber emissions: (1) the low percentage of carbon dioxide(CO_2) in the effluent and (2) the fact that material collected on the filter probably contained soda ash residue from the scrubber. The low percentage of CO_2 found in the flue gas contributed to the high emission rate since this rate is corrected to 12% CO_2 . Probable cause of the low CO_2 value was: (1) scrubber liquid absorbing CO_2 from the flue gas and (2) outside air being drawn into the scrubber through the bypass stack. However, low CO_2 was not the primary factor since boiler 4 emissions through the scrubber were below the standard with essentially the same low percentage of CO_2 in the gas stream. Also, boilers 3 and 4 performed essentially the same through the bypass stack.

It appears that the primary cause for the high emission rate was an upset in the operation of the scrubber such as too high a concentration of soda ash in the scrubbing liquid, thereby causing a carry-over of lime out of the stack.

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EATE	TINE (RILITARY)	BOILER NO.	STACK NO.	B 8	BOILER OPERATING CAPACITY (%)	1001	COAL BEAT VALUE (Btu/lb)	COAL USE (1b/hr)	HEAT IMPUT (MBELU/hr)	*PM EMISSIONS (1b/hr)	PR ENISSIONS (1b/mebtu)
18 NOV 87	1430	•	:	-	100.0		11,066	1,111	49.2	14.27	0.29
19 NOV 87	1002	m	2	~	100.0		11,162	4,427	19.4	14.54	0.29
20 MOV 87	9880	m	=		99.0	H	11,571	4,369	50.8	19.41	0.38
					AVG = 100.0					AVG - 16.07	AVG = 0.32
23 MOV 87	06.30	~	9	-	9. 9. 9.	×	11,439	4,333	49.6	359.87	7.26
23 MOV 87	1000	m	2	~	90.0		11,409	4,000	45.6	140.16	3.07
23 MOV 87	1136	m	2	•	93.0		11,474	4,111	47.3	103.60	2.20
					AVG - 94.0					AVG - 201.23	AVG - 4.10
21 1101 87	9 260	•	=	=	9.0		10,034	4,363	67.3	23.02	6.69
21 MOV 87	1201	•	•	~	9.0	×	11,302	4,375	49.4	29.85	09.0
21 MOV 67	1415	•	•	m	97.0		11,464	4,305	19.4	17.57	0.36
					AVG - 98.0					AVG - 23.48	AVG = 0.48
22 MOV 87	3115	•	¥	-	96.0		11,334	4.278	48.5	41.65	90.0
22 MOV 67	1313	•	2	~	0.46	ĸ	11,356	4,333	49.2	49.57	1.01
22 MOV 87	1500	•	9	•	94.0		11,495	4,183	46.1	.	0.20
					AVG = 96.0					AVG = 33.57	AVG = 0.69

IV. RECOMMENDATIONS

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It is our recommendation that flue gas from the coal-fired boilers continue to be routed through the bypass stack and that the scrubber not be used until retesting conducted to determine the high stack emissions. The scrubber system will be evaluated when we conduct stack emission testing on boiler 5 during March 1988. At this time we will evaluate inlet/outlet flue gas composition to scrubber B(the one tested) and A, as well as evaluating boiler emissions through both scrubber systems(this includes a retest of boiler 3 through the scrubber).

REFERENCES

- 1. "Standards of Performance for New Stationary Sources," Title 40, Part 60, Code of Federal Regulations, July 1, 1986.
- 2. Quality Assurance Handbook for Air Pollution Measurement Systems Volume III, Stationary Source Specific Methods, U.S. Environmental Protection Agency, EPA-600/4-77-027-b, Research Triangle Park, North Carolina, December 1984.
- 3. Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators. U.S. Environmental Protection Agency, EPA-340/1-85-018, Research Triangle Park, North Carolina, May 1987.
- 4. Booth, B.B. "Stack-Pack." Shasta County Air Quality Management District, Redding CA

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APPENDIX A

Personnel Information



1. USAFOEHL Test Team

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Sgt Robert Davis, Environmental Engineering Technician

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3. Environmental Protection Agency, Region V on-site representative

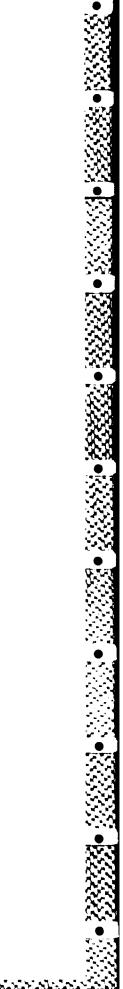
Gerald R. Golubske Phone: (312) 886-1968

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APPENDIX B

State Regulations



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(B) When the owner or operator elects under Section 8(a) [325 IAC 3-2-8(1)] of this Rule to measure carbon dioxide in the flue gases, the measurement of the pollutant concentration and the carbon dioxide concentration shall each be on a consistent basis (wet or dry) and the following conversion procedure used;

$$E = CF_c = \frac{(100)}{(\% CO_2)^2}$$

(C) When the owner or operator elects under Section 8(a) [325 IAC 3-1-8(1)] of this Rule to measure sulfur dioxide or nitrogen oxides in the flue gases, the measurement of the pollutant concentration and the sulfur dioxide and/or the nitrogen oxides concentration(s) shall each be on a wet basis and the following conversion procedure used except where wet scrubbers are employed or where moisture is otherwise added to the stack gases:

$$E = C_w, F_w = \frac{(20.9)}{(20.9 (1-B_{wa})^{-9/0}O_{2w})}$$

(D) When the owner or operator elects under Section 8(a) [325 IAC 3-1-8(1)] of this Rule to measure sulfur dioxide or nitrogen oxides in the flue gases, the measurement of the pollutant concentration and the sulfur dioxide and/or the nitrogen oxides concentrations(s) shall each be on a wet basis and the following conversion procedure used where wet scrubbers or moisture is otherwise present in the stack gases provided water vapor content of the stack gas is measured at least once every fifteen minutes at the same point as the pollutant and oxygen measurements are made;

$$E = C_{w_x}F = \frac{(20.9)}{(20.9 (1-B_{w_s}) - \%0_{2w_s})}$$

(E) The values used in the equations under this Section are derived as follows: C_{ws} = pollutant concentration at stack conditions, g/wscm (grams/wet standard cubic meter), lb/wscm (pounds/wet standard cubic meter), determined by multiplying the average concentration (ppm) for each one hour period by 4.15 X 10⁵ Mg/wscm per ppm (2.59 X 10⁻⁹ M lb/wscm per ppm) where M is pollutant molecular weight, g/g-mole (lb/lb-mole).

M = 64.07 for sulfur dioxide and 46.01 for nitrogen oxides.

C = as above but measured in terms of pounds/dry standard cubic meter (lb/ dscm) or grams/dry standard cubic meter (g/dscm).

F,F = a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F), and a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted (F_c), respectively. Values of F and F_c are given in Section 60.45(f) of 40 CFR Part 60, as applicable.

 $F_{w} = a$ factor representing a ratio of the volume of wet flue gases generated to the calorific value of the fuel combusted. Values of F, are:

(i) For anthracite coal as classified according to A.S.T.M. D388-66, F_{ii} = 1.188 wscm/million calories (10580) wscf/ million BTU).

(ii) For sub-bituminous and bituminous coal as classified according to A.S.T.M. D388-66, $F_u = 1.200 \text{ wscm/}$ million calories (10680 wscf BTU).

(iii) For liquid fossil fuels including crude, residual, and distillate oils, F_w = 1.164 wscm/million calories (10360 wscf/million BTU).

(iv) For gaseous fossil fuels: for natural gas, F_u = 1.196 wscm/million calories (10650 wscf/milion BTU; for propane, F., = 1.150 wscm/million calories (10240 wscf/million Btu); for butane $F_u = 1.172$ wscm/million calories (10430 wscf/million BTU).

 B_{wa} = proportion by volume of water vapor in the ambient air.

 B_{ax} = proportion by volume of water vapor in the stack gas.

 $\%0_2$, $\%CO_2$ = Oxygen or carbon dioxide volume (expressed as percent) determined with equipment specified under Section 8 [325 IAC 3-1-8] of this Rule.

E = pollutant emission, lb/million BTU.

(2) For sulfuric acid plants the owner or operator shall:

(A) Establish a conversion factor three times daily according to the procedures of Section 60.84(b) of 40 CFR Part 60;

(B) Multiply the conversion factor by the average sulfur dioxide concentration in the flue gases to obtain average sulfur dioxide emissions in lb/ton; and

- (C) Report the average sulfur dioxide emission for each 3-hour period in excess of the emission standard set forth in 325 IAC 7-1 (formerly known as APC-13), in the quarterly summary.
- (3) For nitric acid plants the owner or onerator shall:
- (A) Establish a conversion factor according to the procedurders of Section 60.73(b) of 40 CFR Part 60;
- (B) Multiply the conversion factor by the average nitrogen oxides concentration in the flue gases to obtain nitrogen oxides emissions in lb/ton:
- (C) Report the average nitrogen oxides for each averaging period in excess of the emission standard set forth in 325 IAC 10-1 (formerly known as APC-17), in the quarterly summary.
- (4) Alternate Data Reporting and Reduction Procedures.
- (A) Alternate procedures for computing emission averages that do not require integration of data may be approved by the APCB if the owner or operator shows that his procedures are at least as accurate as those in this Rule 1325 IAC 3-11.
- (B) Alternative methods of converting pollutant concentration measurements to units of the emission standard may be approved by the APCB if the owner or operator shows that his procedures are at least as accurate as those in this Rule [325 IAC 3-11.

Rule 2. Source Sampling Procedures

Sec. 1. Applicability, this rule applies to any emissions testing performed in the State to determine compliance with applicable emission limits contained in this Title (Air Pollution Control Board Rules), or for any other purpose requiring review and approval by the APCB

Sec. 2. Adoption of Federal Test Procedures. Emissions tests subject to this Rule shall be conducted in accordance with the procedures and analysis methods specified in Title 40, Code of Federal Regulations Part 60, Appendix A and Part 61 Appendix B, as in effect on December 2, 1981. Such test methods, equipment, calibration requirements, and analysis must be strictly followed unless otherwise approved by the Board or the Technical Secretary. If any test method is revised as contained in the Code of Federal Regulations, this Rule is subject to change pursuant to IC 4-22-2.

- Sec. 3. Requirements Prior to Conducting Tests. (a) When a test is to be performed by any person other than staff, a test protocol form shall be completed and received by the Board no later than 35 days prior to the intended test date. Such test protocol shall be on a form approved by the Board. Any special or unique information relative to the scheduled test shall be included with the form.
- (b) After evaluating the completed test protocol form, the Board or the Technical Secretary.
 - (1) Inspect the test site.
- (2) Require additional conditions, including, but not limited to the following:
- (A) Reasonable modifications to the stack or duct to obtain acceptable test conditions.
- (B) A pretest meeting to resolve an acceptable test protocol,
- (C) Additional tests to allow for adverse conditions such as interferences, nonsteady or cyclic processes.
- (D) The keeping of process operating parameter records, operating logs or charts during the test,
- (E) Conditions on control equipment operation to make it representative of future normal operation, or
- (F) The recording of specified control equipment operating parameters during the test.
- (c) If the Board or the Technical Secretary requires modifications to the test methods, analytical methods, operational parameters or other matters included in the test protocol, or if a pretest meeting is required, the source operator and the testing firm shall be notified by letter or telephone at least 25 days prior to the proposed test date. The source operator will receive notice of the acceptability of the test protocol from the Board or the Technical Secretary within 10 days of its receipt. If the source operator or test firm desires to change any previously submitted procedures or conditions, the Board must be notified of such change at least 25 days prior tot he intended test date, and such changes cannot be made unless approved by the Board or the Technical Secretary prior to the test. Changes in the test protocol that result from emergency conditions

must be approved by an authorized on-site staff member.

- (d) The Board or the Technical Secretary reserves the right to conduct any portion of the reference method tests. In such case, a 25-day notice of proper test procedures will be given to the company and their testing representative.
- days prior to the intended test date. Such \checkmark (e) The source operator must notify the test protocol shall be on a form approved Board of the actual test date at least two by the Board. Any special or unique inforweeks prior to the date.
 - Sec. 4. Performance of Test. (a) Staff may observe the field test procedures and plant operation during the test.
 - (b) All tests shall be conducted while the source is operating at between 95% to 100% of its maximum operating capacity, or under other capacities or conditions specified and approved by the Board or the Technical Secretary. For the purpose of this rule, maximum operating capacity means the maximum design capacity of the source or other maximum operating capacities agreed to by the source and the Board or the Technical Secretary.
 - (c) Sources subject to Article 12 of this Title (New Source Performance Standards) shall be tested under conditions as specified in the applicable Rule.
 - (d) Calibration results of the various sampling components must be available for examination at the test site. The information must include dates, methods used, data and results. All components requiring calibration must be calibrated within 60 days prior to the actual test date. Post test calibrations must be performed on the components within 45 days after the actual test date or before the equipments' next field use whichever comes first. Components requiring calibration are listed in the Federal test methods specified in Section 2 above. Calibration need not be done between tests when several facilities at one location are tested in series, as long as the units are calibrated prior to the first test and after the last test in the series which is conducted at that site.
 - Sec. 5. Test Results and Reports. (a) All tests shall be reported to the Board or the Technical Secretary in the form of a test report containing the following information (which can be kept confidential upon request):
 - (1) Certification by team leader and reviewer.
 - (2) Introduction, containing:

- (A) Date and type of tests,
- (B) Type of process and control equipment,
 - (C) Plant name and location,
 - (D) Purpose of test, and
 - (E) Test participants and titles.
 - (3) Results summary, containing:
- (A) Tabulated data and results of each test run, process weight rate or heat input rate, the stack gas flow rate, the measured emissions given in units consistent with the applicable emission limits, and the visible emissions or average opacity readings, and
 - (B) Allowable emission rate.
 - (4) Process information, including:
- (A) Description of process and control device,
 - (B) Process flow diagram,
 - (C) Maximum design capacities,
- (D) Fuel analysis and heat value for heat input rate determination.
- (E) Process and control equipment operating conditions during tests,
- (F) Discussion of variations from normal plant operations, and
- (G) Stack height, exit diameter, volumetric flow rate (acfm), exit temperature, and exit velocity.
 - (5) Sampling information, including:
- (A) Description of sampling methods used,
- (B) Brief discussion of the analytical procedures with justification for any variance from standard procedures,
- (C) Specification of the number of sampling points, time per point, and total sampling time per run,
- (D) Cross sectional diagram showing sampling points, diagram showing stack dimensions, sampling location and distance from the nearest flow disturbance upstream and downstream of the sampling points, and
 - (E) Sampling train diagram.
 - (6) Appendix, containing:
 - (A) Sampling and analytical procedures
- (B) Results and calculations One complete calculation using actual data for each type of test performed must be shown. Results must be stated to units consistent with the applicable emission limitation.
- (C) Raw production data signed by plant official.
- (D) Photocopies of all actual field data or original raw field data.

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- (E) Laboratory report with chain of custody shown.
 - (F) Copies of all calibration data,
- (G) Applicable regulations showing _ emission limitation, and
- (H) Copies of visible emissions observations or opacity monitor readings (for TSP tests).
- (b) Unless previously agreed to in writing by the Board or the Technical Secretary, all test reports must be received by the Board within forty-five (45) days of the completion of the testing.
- Sec. 6. Special Requirements for Testing Certain Pollutants. (a) Particulate matter tests shall be conducted in accordance with the following procedures:
- (1) Method 5, Title 40 Code of Federal Regulations, Part 60, Appendix A, as in effect on December 2, 1981, or other procedures approved by the Board or the Technical Secretary shall be used.
- (2) Visible emissions (VE) evaluation shall be performed in conjunction with a particulate emissions test by a qualified observer in accordance with the procedures contained in 325 IAC 5-1-4. VE readings shall be continuously recorded for at least 30 minutes per hour of sampling time for each sampling repetition. A variance from this requirement may be granted by the on-site staff person for one repetition only and provided that adverse conditions exist which would invalidate the VE readings. Sources equipped with continuous opacity monitors may submit the monitor's instantaneous or six-minute integrated readings during the sampling period, in lieu of performing VE observations; provided,

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- (A) The monitoring system meets the Performance Specifications Tests 1 as specified in 40 CFR 60, Appendix B as in effect on December 2, 1981, and
- (B) The monitor readings submitted with the test include a zero and span calibration check at the start and end of each test.
- (3) At least three (3) repetitions of the test must be performed under identical source operating conditions unless otherwise allowed by the Board or the Technical Secretary,
- (4) During each of the repetitions, each sampling point shall be sampled for a minimum of two (2) minutes.
- (5) The total test time per repetition shall be no less than sixty (60) minutes.

- (6) The total sample volume per repetition shall be no less than thirty (30) dry standard cubic feet (dscf).
- (7) The total particulate weight collected from the sampling nozzle, probe, cyclone (if used), filter holder (front half), filter and connecting glassware shall be reported. Particulate analysis of the impinger catch is not required unless specified by staff.
- (b) Sulfur dioxide (SO₂) tests shall be conducted in accordance with the following procedures:
- (1) Method 6 or Method 8, Title 40 Code of Federal Regulations, Part 60, Appendix A, as in effect on December 2, 1981, or other procedures approved by the Board or the Technical Secretary shall be used.
- (2) At least three (3) repetitions of two (2) samples, each of Method 6 or three (3) repretitions of Method 8 performed under identical source operting conditions, shall constitute a test.
- (3) During each of the repetitions for Method 8, each sampling point shall be sampled for a minimum of two (2) minutes.
- (4) The total test time per repetition shall be as follows:
- (A) Method 6 a minimum of 20 minutes per run with a 30 minute interval between each run, or
- (B) Method 8 a minimum of 60 minutes per run.
- (5) The total sample volume per repetition under Method 8 shall be no less than 40 dry standard cubic feet (dscf).
- (c) Nitrogen oxide tests shall be conducted in accordance with the following procedures:
- (1) Method 7, Title 40, Code of Federal Regulations, Part 60, Appendix A as in effect on December 2, 1981, or other procedures approved by the Board or the Technical Secretary shall be used.
- (2) At least three (3) repetitions of four(4) samples each shall constitute a test.
- (d) Volatile Organic Compounds (VOC) emissions tests shall be conducted in accordance with the following procedures:
- (1) Method 25, Title 40 Code of the Federal Regulations, Part 60, Appendix A as in effect on December 2, 1981, or other procedures approved by the Board or duly authorized staff member shall be used for

- the total non-methane organic (TNMO) emissions.
- (2) At least three (3) duplicate samples must be collected and analyzed.
- (3) The total test time per repetition shall be a minimum of sixty (60) minutes.
- Sec. 7. Invalid Tests. Any tests not meeting the requirements of this Rule may be treated by staff and the Board as invalid for any and all purposes.
- Sec. 8. Board Resolves Disputes. A source operator or testing firm may appeal to the Board any decision made by staff under the discretionary terms of this Rule. Any person desiring to make such an appeal shall notify staff of the matters to be appealed, and, if agreement cannot be reached, the matter shall be presented to the Board for a final determination. The Board may appoint one of its members to hear the matter and make recommendations for a final decision by the full Board.

ARTICLE 4. BURNING REGULATIONS

Rule 1. Open Burning

- Sec. 1. Applicability—This Rule [325 IAC 41-] establishes standards for the open burining of material which would result in emissions of regulated pollutants and applies everywhere in the State. However, this Rule [325 IAC 4-1] shall not apply in areas where acts permitted by Section 3 [325 IAC 4-1-3] or authorized by variance pursuant to Section 4 [325 IAC 4-1-4] are prohibited by other State and/or local laws, regulations, or ordinances such as IC 13-7-4-1(g).
- Sec. 2. Prohibition—No persons shall open burn any material except as provided in Section 3 [325 IAC 4-1-3] or Section 4 [325 IAC 4-1-4].
- Sec. 3. Exemptions. (a) The following types of fires are permitted:
- (1) Fires celebrating Twelfth Night Ceremonies.
 - (2) Fires celebrating school pep rallies.
 - (3) Fires celebrating scouting activities.
 - (4) Camp fires.
- (5) Residential burning—where residence contains four or fewer units. Burning shall be in a noncombustible container with enclosed sides a bottom, and a mesh covering with openings no larger than 1/4" square. Burning is prohibited in apartment complexes and mobile home parks.

- (6) Farm burning—wood products derived from farming operations. Clearing operations (Section 4(a)(4) [325 IAC 4-1-4(a)(4)] are not considered farm burning.
- (7) Waste oil burning—where the waste oil has been collected in a properly constructed and located pit as prescribed in 310 IAC 7-1-37(A) (Rule 37A of the Division of Oil and Gas, Department of Natural Rersouces) at an oil well. Each oil pit may be burned once every two (2) months and all the oil must be completely burned within thirty (30) minutes after ignition
- (b) All exemptions shall be subject to the following:
- (1) Only wood products shall be burned unless otherwise stated above.
- (2) Fires shall be attended at all times until completely extinguished.
- (3) If fires create an air pollution problem, a nuisance, or a fire hazard, they shall be extinguished.
- (4) All residential, farm operation, and waste oil burning shall occur during daylight hours during which the fires may be replenished, but only in such a manner that nearly all of the burning material is consumed by sunset.
- (5) No burning shall be conducted during unfavorable meteorological conditions such as temperature inversions, high winds, air stagnation, etc.
- Sec. 4. Variances. (a) Burning with prior approval of the board or its designated agent may be authorized for the following:
- (1) Emergency burning of petroleum products.
- (2) Burning of refuse consisting of material resulting from a natural disaster.
- (3) Burning for the purpose of fire training.
- (4) Burning of natural growth derived from a clearing operation, i.e., removal of natural growth for change in use of the land.
- (5) Burning of highly explosive or other dangerous materials.
- (b) Burning not exempted by Section 3 [325 IAC 4-1-3] may be permitted with prior receipt of a variance application and approval of the Board. (Air Pollution Control Board)
- Sec. 5. Liability—Any person who allows the accumulation or existence of

combustible material which constitutes or contributes to a fire causing air pollution shall not be excused from responsibility therefore on the basis that said fire was accidental or an act of God.

Rule 2. Incinerator

- Sec. 1. Applicability—This Rule [325 IAC 4-2] establishes standards for the use of incinerators which emit regulated pollutants. This rule [325 IAC 4-2] does not apply to incinerators in residential units consisting of four or fewer families. All other incinerators are subject to this rule. [325 IAC 4-2].
- Sec. 2. Stationary Incinerators—All stationary incinerators shall:
- (1) Consist of primary and secondary chambers or the equivalent.
- (2) Be equipped with a primary burner unless burning wood products.
- (3) Comply with 325 IAC 5-1 (formerly known as APC 3) and 325 IAC Article 2 (formerly known as APC 19).
- (4) Be maintained properly as specified by the manufacturer and approved by the Board or its designated agent.
- (5) Be operated according to the manufacturer's recommendations and only burn waste approved by the Board or its designated asgent.
- (6) Comply with other state and/or local regulations or ordinances regarding installation and operation.
- (7) Be operated so emissions of hazardous material including, but not limited to, viable pathogenic bacteria, dangerous chemicals or gases, or noxious odors are prevented
- (8) Not emit particulate matter in excess of the following:
- (A) Incinerators with a maximum refuse-burning capacity of 200 or more pounds per hour: 0.3 pounds of particulate matter per 1,000 pounds of dry exhaust gas at standard conditions as corrected to 50% excess air.
- (B) All other incinerators: 0.5 pounds of particulate matter per 1,000 pounds of dry exhaust gas at standard conditions corrected to 50% excess air.
- (9) Not create an air pollution problem, a nuisance or a fire hazard. If any of the above result, the burning shall be terminated immediately
- Sec. 3. Portable Incinerators—All portable incinerators shall be subject to the following conditions:

- (1) Approval of the Board or its designated agent must be obtained prior to operation at a new project site.
- (2) Only wood products shall be burned.
- (3) Merchantable material shall be salvaged where practicable.
- (4) The local health department shall be notified prior to any burning.
- (5) All burning shall be conducted under favorable meteorological conditions.
- (6) Burning shall occur during daylight hours and all material shall be consumed by sunset.
- (7) If burning creates an air pollution problem, a nuisance or a fire hazard, the burning shall be terminated immediately.
- (8) The incinerator shall be maintained and operated according to the manufacturer's recommendations and in a manner approved by the Board or its designated agent.
- (9) The installation and operation of such an apparatus shall comply with all other state and/or local regulations or ordinances.
- (10) A portable incinerator shall comply with both 325 IAC 5-1 (formerly known as APC 3) and 325 IAC, Article 2 (formerly known as APC 19).

ARTICLE 5. OPACITY REGULATIONS

Rule 1. Opacity Limitations

- Sec. 1. Applicability. (a) This rule [325 IAC 5-1] shall apply to all visible emissions (not including condensed water vapor) emitted by or from any facility or source except those sources or facilities for which specific visible emission limitations are established by 325 IAC, Article 11, 325 IAC, Article 12, or 325 IAC, Article 6.
- (1) The requirements of Section 2(a)(1) [325 IAC 5-1-2(a)] shall apply to sources or facilities located in attainment areas for particulate matter, designated in 325 IAC 1.1-3 (formerly known as APC 22).
- (2) The requirements of Section 2(a)(2) [325 IAC 5-1-2(a)(2)] shall apply to sources or facilities located in nonattainment areas for particulate matter as designated in 325 IAC 1.1-3 (formerly known as APC 22)
 - (b) Sources or facilities located in areas

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designated as unclassifiable or attainment areas in 325 IAC 1.1-3 (formerly Regulation APC 22) which became subject to more stringent limitations as a result of said area being redesignated as a nonattainment area by the Board, shall comply with such limitations as expeditiously as practable, but no later than December 31, 1982. No later than 60 days after the promulgation of the nonattainment designation in 325 IAC 1.1-3, all sources or facilities subjected to more stringent visible emission limitations by their redesignation shall submit to the Board for approval a schedule for attaining compliance with this Rule [325 IAC 5-1].

- Sec. 2. Emission Limitations. (a) Visible emissions from any source or facility shall not exceed any of the following limitations. Unless otherwise stated, all visible emissions shall be observed in accordance with the procedures set forth in Section 4 [325 IAC 5-1-4] of this rule:
- (1) Sources or facilities of visible emissions located in attainment areas for particulate matter shall meet the following limitations:
- (A) Visible emissions shall not exceed, an average of 40% opacity in 24 consecutive readings.
- (B) Visible emissions shall not exceed 60% opacity for more than a cumulative total of 15 minutes (60 readings) in a 6-hour period.
- (2) Sources or facilities of visible emissions located in nonattainment areas shall meet the following limitations:
- (A) Visible emissions shall not exceed, an average of 30% opacity in 24 readings.
- (B) Visible emissions shall not exceed 60% opacity for more than a cumulatie total of 15 minutes (60 readings) in a 6-hour period.
- (3) Sources and facilities of visible emissions located in both attainment or nonattainment areas, for which an alternate visible emission limitation has been established pursuant to Secton 5(b) [325 IAC 5-1-5(b)] herein, shall comply with said limitations in lieu of the limitations set forth in subsection 2(a)(1) and 2(a)(2) [subsections (a)(1) and (a)(2) of this section] preceding.
- Sec. 3. Temporary Exemptions. (a) Boiler Startup and Shutdown—When building a new fire in a boiler, or shutting down a boiler, visible emissions may ex-

ceed the applicable opacity limit established in Section 2(a) [325 IAC 5-1-2(a)]; however, visible emissions shall not exceed an average of 60% opacity and emissions in excess of the applicable opacity limit shall not continue for more than 10 continuous minutes on one occasion in any 24-hour period.

- (b) Cleaning Boilers—When removing ashes from the fuel bed or furnace in a boiler or blowing tubes, visible emissions may exceed the applicable opacity limit established in Section 2(a) [325 IAC 5-1-2(a)], however, visible emissions shall not exceed 60% opacity and visible emissions in excess of the applicable opacity limit shall not continue for more than five continuous minutes on one occasion in any 60-minute period. Such emissions shall not be permitted on more than three occasions in any 12-hour period.
- (c) Facilities not temporarily exempted by Subsections (a) and (b) above may be granted special temporary exemptions by the Board of the same duration and type authorized therein provided that the facility proves to the satisfaction of the Board that said exemptions are needed and that during periods of startup and shutdown, owners and operators shall, to the extent practicable, maintain and operate any affected facility including air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Board, which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures and inspection of the source.
- (d) Sources or facilities not exempted through subsections (a), (b), or (c) above may also be granted special exemptions by the Board, provided that the source or facility owner or operator proves to the satisfaction of the Board that said exemption is justifiable. Said exemption(s) may be of longer duration and may apply to other types of facilities not provided for in subsections (a) and (b) above.
- Sec. 4. Procedure to Determine Compliance. (a) Determination of visible emissions from sources or facilities to which this Rule [325 IAC 5-1] applies may be

made in accordance with subsections (1) and (2) below.

- (1) Determination of visible emissions by means of a qualified observer shall be made according to the following provisions (A) through (H).
- (A) Position—The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun, if visible, oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from the position such that his line of vision is approximately perpendicular to the direction of the visible emissions (plume where applicable), and when observing opacity of emissions from rectangular outlets (e.g., monitors open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).
- (B) Field Records—The observer shall record the name of the plant, emission location, type of facility, observer's name and affiliation, and the date on a field data sheet. Time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky conditions (presence and color of clouds), and visible emissions (plume where applicable) background are recorded on a field data sheet at the time opacity readings are initiated and completed.
- (C) Observations—Opacity observations shall be made at the point of greatest opacity in that portion of the visible emissions, (plume where applicable) where condensed water vapor is not present. The observer shall not look continuously at the visible emissions, (plume where applicable) but instead shall observe the visible emissions, (plume where applicable) mometarily at 15-second intervals.
- (D) Recording Observations—Opacity observations shall be recorded to the nearest 5% at 15-second intervals on an observational record sheet. A minimum of 24 observations shall be recorded. Each

momentary observation shall be deemed to represent the average opacity of emissions for a 15-second period.

- (E) Determination of Opacity As An Average of 24 Consecutive Observations-Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. Record the average opacity on a record sheet. For the purpose of determining an alternative visible emission limit in accordance with Section 5(b) [325 IAC 5-5-5(b)] following, an average of 24 consecutive readings or more may be used to calculate the alternative visible emissions limit.
- (F) Determination of Opacity As A Cumulative Total of 15 Minutes—For emissions from intermittent sources, opacity shall be determined in accordance with subsections (1), (2), (3), and the first sentence of (4). Each momentary observation shall be deemed to represent the average opacity of emissions for a 15 second period. All readings greater than the specified limit in Section 2 [325 IAC 5-1-2] shall be accumulated as 15 second segments for comparison with the limit.
- (G) Attached Steam Plumes—When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.
- (H) Detached Steam Plumes—When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet priror to the condensation of water vapor and the formation of the steam plume.
- (2) Determination of compliance with visible emission limitations established in this Rule [325 IAC 5-1] may also be made

- in accordance with a source's or facility's continuous monitoring equipment, for any source or facility in compliance with the requirements of 325 IAC 3-1.
- (b) If the compliance determination procedures set forth in subsection (1) and (2) preceding results in any conflict in visible emission readings, the determination made in accordance with subsection (2) above shall prevail for the purpose of compliance, provided that it can be shown that the continuous monitor has met the performance specifications as set forth in the U.S. EPA Federal Reference 40 CFR, Part 60, specifically Performance Specification 1.
- Sec. 5. Special Considerations. (a) A violation of this Rule [325 IAC 5-1] shall constitute prima facie evidence of a violation of other applicable particulate emission control regulations. A violation of any such regulation can be refuted by a performance test conducted in accordance with paragraph (b), below. Such test shall refute the mass emission violation only if the source is shown to be in compliance with the allowable mass emission limit. An exceedance of the allowable opacity emission limit will not be treated as a violation if, during the test described in (b) below, the source demonstrates compliance with the allowable mass emission limit while simultaneously having visible emissions more than or equal to the reading at which the exceedance was originally observed.
- (b) Establishment or Alternate Visible Emission Limits-The owner or operator of a source or facility which believes it can operate in compliance with the applicable mass emission limitation, but exceeds the limits specified in Section 2 [325 IAC 5-1-21 of this Rule, may submit a written petition to the Technical Secretary requesting that an alternate opacity limitation be established pursuant to the following provisions Additionally, if the Board has issued a Notice of Violation to an owner or operator of a source or facility for violation of the applicable opacity limitation, such owner or operator may, propose in Notice of Violation resolution, to disprove said violation by establishing an alternate opacity limit pursuant to the following provisions. This alternate limit shall be based upon a mass emission performance test conducted according to a

- method designated by the Board, and a visible emission test conducted simultaneously, according to Section 4 [325 IC 5-1-4] of this Rule. Where the Board determines there is no acceptable test method available, a request for an alternate visible emission limit shall be denied.
- (1) The alternate emission limit shall be equal to that level of opacity at which the source or facility will be able, as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source or facility is meeting the mass emission limitation. However, the Board shall also reserve the right to determine the alternate visible emissions limit in the following manner:
- (A) If a performance test of a source or facility demonstrates (i) that said source or facility is in compliance with the allowable mass emissions limit (as defined in 325 IAC 1.1.-1) at the time that the test is done, and: (ii) simultaneously, said source's or facility's test demonstrates that the allowable opacity emission limit is being exceeded, then, the enforceable opacity limitation shall be equal to that level of opacity at which the source or facility will be able as indicated by the performance and opacity tests to meet the opacity standard at all times during which the source or facility is meeting the mass emission limitation.
- (B) If a performance test of a source or facility demonstrates (i) that said source of facility is in compliance with the allowable mass emission limit, and the test mass emission rate is within 10% of the allowable emissions limit for that source or facility, and; (ii) simultaneously, said source's or facility's test demonstrates that the opacity observed is below the allowable opacity emission limit, the enforceable opacity limitation shall be equal to that level of opacity at which the source or facility will be able as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source or facility is meeting the mass emission limitation.
- (C) If a performance test of a source or facility demonstrates (i) that said source or facility is in compliance with the allowable mass emission limit, and the test mass emission rate is less than 90% of the allowable emissions limit and; (ii)

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simultaneously, said source's or facility's test demonstrates that the opacity observed is below the allowable opacity emission limit, the enforceable opacity limitation shall remain the existing allowable opacity emission limitation for that source or facility.

- (2) Compliance with 325 IAC 6-2 (formerly known as APC 4R), 325 IAC 6-3 (formerly known as APC 5), 325 IAC 11-1 (formerly known as APC 6), and 325 IAC 6-1 (formerly known as APC 23), and other applicable regulations must be demonstrated by the performance test.
- (3) The Board may require a performance test in any case where it is necessary to determine the compliance status for a facility. However, the Board will not request a performance test for any facility which is known to be in compliance with the allowable opacity limitation.
- (4) All alternate visible emission limits shall be established on a source or facility-specific basis. No limitation for any facility or source shall be established by reference to a similar or identical facility or source.
- (5) The owner or operator of the source or facility shall notify the Board at least fifteen days prior to conducting a test for the purposes of demonstrating an alternate visible emission limit.
- (6) A staff member who is a qualified observer, approved by the Board or other consultant approved by the Board shall be present during any performance tests.
- (7) The cost of the performance test shall be at the expense of the owner or operator.
- (8) Any alternate visible emission limit established for any source or facility shall not become effective until said limitation is established in the applicable operating permit. Said limitation will be incorporated, by amendment, into the operating permit for said source or facility and submitted to the U.S. EPA as a SIP revision.
- (9) Where a visible emission limitation is based upon a New Source Performance Standard, any new limitation must comply with the provisions of said standard.
- Sec. 6. Compliance Timetables—Sources newly subject to more stringent limitations at the promulgation date of this Rule [325 IAC 5-1] by Section 2 [325 IAC 5-2-1] shall comply with the compliance schedule of 325 IAC 6-1 (formerly known as APC 23).

Sec. 7. SIP Revision—Any exemptions given or provisions granted to this rule [325 IAC 5-1] by the Board in Sections 3 (c) [325 IAC 5-3-2(c)] or 5(b) [325 IAC 5-1-5(b)] shall be submitted to the U.S. EPA as revisions to the State Implementation Plan.

ARTICLE 6. PARTICULATE REGULATIONS

Rule 1. Nonattainment Area Limitations

- Sec. 1. Applicability. Sources or facilities specifically listed in Appendix A [325 IAC 6-1-7] of this Rule shall comply with the limitations contained therein. Sources or facilities that are (1) located in the nonattainment counties listed in Appendix A [325 IAC 6-1-7], (2) but which sources or facilities are not specifically listed in Appendix A [325 IAC 6-1-7], and (3) have the potential to emit 100 tons or more of particulate matter per year or have actual emissions of 10 tons or more of particulate matter per year, shall comply with the limitations of Section 2 [325 IAC 6-1-2], hereof.
- Sec. 2. Emission Limitations. (a) General Sources-Facilities not limited by paragraphs (b) through (g) below shall not allow or permit discharge to the atmosphere any gases which contain particulate matter in excess of 0.07 gram per dry standard cubic meter (g/dscm) (0.03 grain per dry standard cubic foot (dscf)). Where this limitation is more stringent than the applicable limitations of paragraphs (b) through (g) of this section, for facilities in existence prior to the applicability dates, or of a size not applicable to said paragraphs, emission limitations for those facilities shall be determined by the Board and will be established in accordance with the procedures set forth in paragraph (h) of this section.
- (b) Fuel Combustion Steam Generators—No person shall operate a fossil fuel combustion steam generator (any furnace or boiler used in the process of burning solid, liquid, or gaseous fuel or any combination thereof for the purpose of producing steam by heat transfer) so as to discharge or cause to be discharged any gases unless such gases are limited to:
- (1) A particulate matter content of no greater than 0.18 grams per million calo-

- ries (0.10 pounds per million Btu) for solid fuel fired generators of greater than 63 million kilocalories (kcal) per hour heat input (250 million Btu);
- (2) A particulate matter content of no greater than 0.63 grams per million calories (0.35 pounds per million Btu) for solid fuel fired generators of equal to or greater than 6.3 but less than or equal to 63 million kcal per hour heat input (25 but less than or equal to 250 million Btu);
- (3) A particulate matter content of no greater than 1.08 grams per million calories (0.6 pounds per million Btu) for solid fuel fired generators of less than 6.3 million kcal per hour heat input (25 million Btu);
- (4) A particulate matter content of no greater than 0.27 grams per million kcal (0.15 pounds per million Btu) for all liquid fuel fired steam generators.
- (5) A particulate matter content of no greater than .01 grains per dry standard cubic foot for all gaseous fuel-fired steam generators.
- (c) Aspalt Concrete Plants—The requirements of this provision shall apply to any asphalt concrete plant (any facility used to manufacture asphalt concrete by heating and drying aggregate and mixing with asphalt cement). An asphalt concrete plant is deemed to consist only of the following: driers, systems for screening, handling, storing, and weighing hot aggregate; systems for loading, transferring, and storing mineral filler; systems for mixing asphalt concrete; and the loading, transfer, and storage systems associated with emission control systems.
- (1) No person shall operate the affected facilities of an asphalt concrete plant which existed on or prior to June 11, 1973, so as to discharge or cause to be discharged into the atmosphere any gases unless such gases are limited to:
- (A) A particulate matter content of no greater than 230 mg per dscm (0.10 grain per dscf).
- (d) Grain Elevators—No person shall operate a grain elevator (a grain elevator is defined as any plant or installation at which grain is unloaded, handled, cleaned, dried, stored or loaded) without meeting the provisions of this Section. Paragraph (1) below shall apply to any grain storage elevator located at any grain processing source which has a permanent

* Rule 2. [Repealed]

Rule 2.1. Particulate Emission Limitations for Sources of Indirect Heating

Sec. 1. Applicability. This rule establishes limitations for sources of indirect heating. (a) Particulate emissions from the combustion of fuel for indirect heating from all facilities located in Lake, Porter, Marion, Boone, Hamilton, Hendricks, Johnson, Morgan, Shelby, and Hancock Counties which were existing and in operation or which received permit to construct prior to the effective date of this rule (325 IAC 6-2.1) shall be limited by section 2 below.

(b) Particulate emissions from the combustion of fuel for indirect heating from all facilities not specified in (a) which were existing and in operation or which received permits to construct prior to the effective date of this rule (325 IAC 6-2.1) shall be limited by section 3 below.

(c) Particulate emissions from the combustion of fuel for indirect heating from all facilities receiving permits to construct on or a fier the effective date of this rule (325 IAC 6-2.1) shall be limited by section 4 below.

(d) If any limitation established by this rule (325 IAC 6-2.1) is inconsistent with applicable limitations contained in 325 IAC 6-1, then the limitations contained in 325 IAC 6-1 prevail.

(e) If any limitation established by this rule (325 IAC 6-2.1) is inconsistent with applicable limitations contained in 325 IAC article 12.1 (New Source Performance Standards) then the limitations contained in 325 IAC article 12.1 prevail.

(f) If any limitation established by this rule (325 IAC 6-2.1) is inconsistent with a limitation contained in a facility's construction or operation permit as issued pursuant to 325 IAC article 2 (Permit Review Regulations), then the limitations contained in the source's current permits prevail.

(g) If any limitation established by this rule (325 IAC 6-2.1) is inconsistent with a limitation required by 325 IAC article 2 (Permit Review Regulations) to prevent a violation of the Ambient Air Quality Standards set forth in 325 IAC 1.1-3, then the limitations required by 325 IAC article 2 prevail.

(h) The addition of a new facility at a

source does not affect the limitations of the existing facilities unless such changes in the limitations are required by the provisions of 325 IAC article 2 or 325 IAC 6-1.

Sec. 2. Emission limitations for facilities specified in 325 IAC 6-2.1-1(a). (a) Particulate emissions from existing indirect heating facilities located in the specified counties shall be limited by the following equation.

$$Pt = \frac{0.87}{\Omega^{0.16}}$$

Where:

Pt = Pounds of particulate matter emitted per million Btu (lb/mmBtu) heat input.

Q = Total source maximum operating capacity rating in million Btu per hour (mmBtu/hr) heat input. The maximum operating capacity rating is defined as the maximum capacity at which the facility is operated or the nameplate capacity, whichever is specified in the facility's operation permit application, except when some lower capacity is contained in the facility's operation permit, in which case, the capacity specified in the operation permit shall be used.

For Q less than 10 mmBtu/hr, Pt shall not exceed 0.6.

For Q greater than or equal to 10,000 mmBtu/hr, Pt shall not exceed 0.2. Figure 1 may be used to estimate allowable emissions.

(b) The emission limitations for those indirect heating facilities which were existing and in operation on or before June 8, 1972, shall be calculated using the equation contained in subsection 2(a) where: Q shall reflect the total source capacity on June 8, 1972. The resulting Pt is the emission limitation for each facility existing on that date and will not be affected by the addition of any subsequent facility. The particulate emissions from all of the facilities which were in existence on June 8, 1972, may be allocated in any way among these facilities provided that they will not result in a significantly greater air quality impact level at any receptor than that which would result if the particulate emissions from each of these facilities were limited to Pt; and provided that the emission limitations for each facility are

specified in its operation permit. Significant impact levels are defined in 325 IAC 2-3, section 2(d).

(c) The emission limitations for those indirect heating facilities which began operation after June 8, 1972, and before the effective date of this rule (325 IAC 6-2.1). and those facilities which receive permits to construct prior to the effective date of this rule (325 IAC 6-2.1) shall be calculated using the equation contained in subsection 2(a) where: Q includes the capacity for the facility in question and the capacities for those facilities which were previously constructed or received prior permits to construct. The limitations for all previously permitted facilities do not change. The Q and Pt for each facility at a source which begins operation or receives a construction permit during this time period will be different.

Sec. 3. (a) Particulate emissions from indirect heating facilities existing and in operation before the effective date of this rule shall be limited by the following equation:

$$Pt = \frac{C X a X h}{76.5 X Q^{0.75} X N^{0.25}}$$

Where

C = Maximum ground level concentration with respect to distance from the point source at the "critical" wind speed for level terrain. This shall equal 50 micrograms per cubic meter (ug/m³) for a period not to exceed a 60-minute time period.

Pt = Pounds of particulate matter emitted per million Btu heat input (lb/mmBtu).

Q = Total source maximum operating capacity rating in million Btu per hour (mmBTU/hr) heat input. The maximum operating capacity rating is defined as the maximum capacity at which the facility is operated or the nameplate capacity, whichever is specified in the facility's operation permit application, except when some lower capacity is contained in the facility's operation permit; in which case, the capacity specified in the operation permit shall be used.

N = Number of stacks in fuel burning operation.

a = Plume rise factor which is used to make allowance for less than theoretical

plume rise. The value 0.67 shall be used specified in its operation permit. Signififor Q less than or equal to 1,000 mmBtu/hr heat input. The value 0.8 shall be used for Q greater than 1,000 mmBtu/hr heat input.

h = Stack height in feet. If a number of stacks of different heights exist, the average stack height to represent "N" stacks shall be calculated by weighing each stack height with its particulate matter emission rate as follows:

$$h = \frac{\sum_{i=1}^{N} H_i X pa_i X Q_i}{\sum_{i=1}^{N} pa_i X Q_i}$$

$$\sum_{i=1}^{N} pa_i X Q_i$$

Where:

ASSISTANCE CONTRACTOR CONTRACTOR

pa=the actual controlled emission rate in lb/mmBtu using the emission factor from AP-42 or stack test data. Stacks constructed after January 1, 1971, shall be credited with GEP stack height only. GEP stack height shall be calculated as specified in rule 325 IAC 1.1-6.1

(b) The emission limitations for those indirect heating facilities which were existing and in operation on or before June 8, 1972, shall be calculated using the equation contained in subsection 3(a) where: Q, N, and h shall include the parameters for all facilities in operation on June 8, 1972. The resulting Pt is the emission limitation for each facility existing on that date and will not be affected by the addition of any subsequent facility. The particulate emissions from all of the facilities which were in existence on June 8, 1972, may be allocated in any way among these facilities provided that they will not result in a significantly greater air quality impact level at any receptor than that which would result if the particulate emissions from each of these facilities were limited to Pt; and provided that the emission limitations for each facility are

cant impact levels are defined in 325 IAC 2-3 section 2(d).

- (c) The emission limitations for those indirect heating facilities which began operation after June 8, 1972, and before the effective date of this rule (325 IAC 6-2.1). and those facilities which receive permits to construct prior to the effective date of this rule (325 IAC 6-2.1) shall be calculated using the equation contained in subsection 3(a) where: Q, N, and h shall include the parameters for the facility in question and for those facilities which were previously constructed or received prior permits to construct. The limitations for all previously permitted facilities do not change. The Q, N, h, and Pt for each facility at a source which begins operation or receives a construction permit during this time period will be different.
- (d) Particulate emissions from all facilities used for indirect heating purposes which were existing and in operation on or before June 8, 1972, shall in no case exceed 0.8 lb/mmBtu heat input.
- (e) Particulate emissions from any facility used for indirect heating purposes which has 250 mmBtu/hr heat input or less and which began operation after June 8, 1972, shall in no case exceed 0.6 lb/mmBtu heat input.

Sec. 4. Emission limitations for facilities specified in 325 IAC 6-2.1-1(c) (a) Particulate emissions from indirect heating facilities constructed after the effective date of this rule (325 IAC 6-2.1) shall be limited by the following equation:

$$Pt = \frac{1.09}{Q^{0.26}}$$

Where:

Pt = Pounds of particulate matter emitted per million Btu (lb/mmBtu) heat

O = Total source maximum operating capacity rating in million Btu per hour (mmBtu/hr) heat input. The maximum operating capacity rating is defined as the maximum capacity at which the facility is

operated or the nameplate capacity, whichever is specified in the facility's permit application, except when some lower capacity is contained in the facility's operation permit; in which case, the capacity specified in the operation permit shall be

For Q less than 10 mmBtu/hr, Pt shall not exceed 0.6.

For Q greater than or equal to 10,000 mmBtu/hr, Pt shall not exceed 0.1. Figure 2 may be used to estimate allowable emissions.

(b) As each new indirect heating facility is added to a plant Q will increase. As a result, the emission limitation for each progressively newer facility will be more stringent until the total plant capacity reaches 10,000 mmBtu/hr after which the emission limit for each newer facility will be 0.1 lb/mmBtu heat input. The rated capacities for facilities regulated by article 12.1, New Source Performance Standards, shall be included when calculating Q for subsequent facilities.

Rule 3. Process Operations

Sec. 1. Applicability—This Rule [325 IAC 6-31 establishes emission limitations for particulate emissions from process operations located anywhere in the State. The following processes and their attendant emissions are exempt from this Rule [325 IAC 6-3]:

- (1) Combustion for indirect heating
- (2) Incinerators
- (3) Open burning
- (4) Existing Foundry Cupolas

If any limitation established by this Rule [325 IAC 6-3] is inconsistent with applicable limitations contained in 325 IAC 6-1 (formerly known as APC 23), or contained in 325 IAC, Article 12 (New Source Performance Standards), then the limitation contained herein shall not apply; but the limit in such sections shall apply.

Sec. 2. Emission Limitations. (a) Cement Kilns-No owner or operator of a cement manufacturing operation commencing operation prior to December 6, 1968, equipped with electrostatic

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APPENDIX C

Plant Operating Data

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BOILER #3, BY PMSS, RUN#3

Secretary Secre

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BOILER #4, BYPASS, RUNS#1,2,3

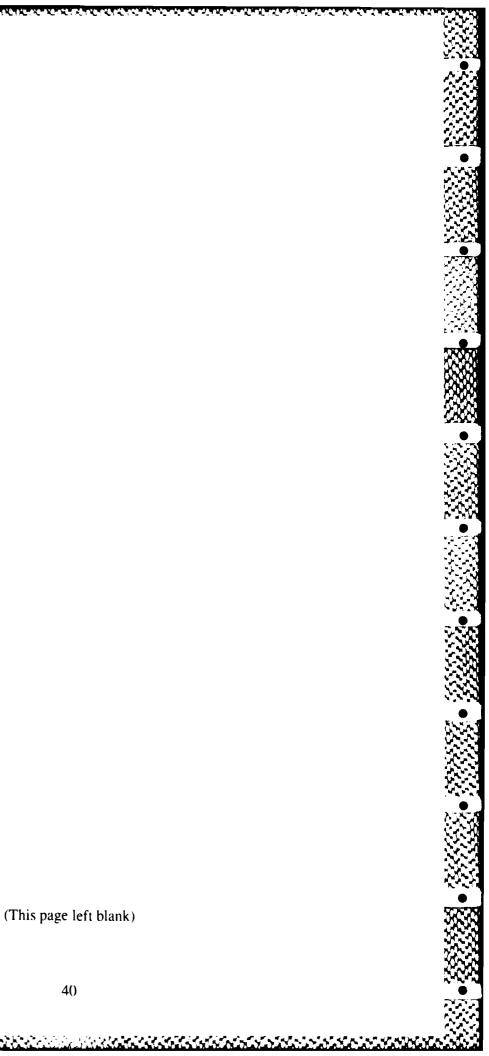
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BOILERHY, SCRUBBER, RUNS #1,2,3

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APPENDIX D

Coal Analysis





# CORE LABORATORIES, INC.

ANALYTICAL REPORT

2315 GLENVIEW AVE, EVANSVILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971-500

FILE NUMBER: GA121487

IDENTIFICATION

SAMPLE NO. : 0001

CAN NUMBER 4279

INVOICE JOR #: C71928

(BOLER #3)

BYPASS

LOCATION #: 63120

RUN#1

	AS RECEIVED BASIS	AIR DRIED BASIS	DRY BASIS
% MOISTURE % ASH % VOLATILE % FIXED CARRON	18.75 4.30 28.78 48.17	4.44 5.06 33.85 56.66	5.29 35.42 59.29
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR BTU/LB. MAF BTU/LB.	0.80 11,066	0.95 13,015	0.99 13,620 14,380
LBS SULFUR/MM BTU LBS WATER/MM BTU LBS ASH/MM BTU	0.72 16.94 3.89		

ASH SOFTENING TEMP: 2675 DEGREE F.

RESPECTFULLY SUBMITTED,

Kevin J. Weil



ternational CORE LABORATORIES, INC.

ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSUILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE

GRISSOM A.F.B., IN 46971-500

FILE NUMBER: GA121087

SAMPLE NO. : 0002

INVOICE JOB #: C71928

LOCATION #: 63120

IDENTIFICATION

CAN NUMBER 1300

(BOILER#3)

	AS RECEIVED BASIS	AIR DRIED BASIS	DRY Basis
% MOISTURE % ASH % VOLATILE % FIXED CARBON	17.76 5.27 29.42 47.55	4.82 6.10 34.05 55.03	 6.41 35.77 57.82
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR BTU/LB. MAF BTU/LB.	0.76 11,162	0.98 12,717	0.92 13,573 14,501
LBS SULFUR/MM RTU LBS WATER/MM BTU LBS ASH/MM ETU	0.48 15.91 4.72		

ASH SOFTENING TEMP: 2700+ DEGREE F.

77.:

RESPECTFULLY SUBMITTED,



THE CORE LABORATURIES, INC.

CORE LABORA

Western Adde International Core Laboraturies, inc.

ANALYTICAL REPORT

2315 GLENVIEW AVE, EVANSVILLE, IN 47712 (812) 424-2909

17-DEC-87

DEPT. OF THE AIR FORCE
305 CSG/DE GRISSOM A.F.R., IN 46971-500

FILE NUMBER: GA121087 INENTIFICA CAN NUMBER 2284 (Bullet No.: 0003 CAN NUMBER 2284 (Bullet No.: 0

**IDENTIFICATION** 

AS RECEIVED AIR DRIED ORY BASIS BASIS BASIS % MOISTURE 14.70 4.43 % ASH 5.23 5.86 5.13 ∨OLATILE 30.65 34.39 35.98 % FIXED CARBON 49.38 55.33 57.89 TOTAL PERCENTAGE 100.00 100.00 100.00 % SULFUR 0.74 0.83 0.87 BTU/LB. 11,571 12,964 13,565 MAF BTU/LB. 14,451 LBS SULFUR/HM BTU 0.64 LBS WATER/MM BTU 12.70 LRS ASH/MH RTU 4.52

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED;

Kevin J. Weil



**CORE LABORATORIES* INC.

ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSVILLE, IN 47712 (812) 424-2909

04-JAN-88

DEFT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971~500

FILE NUMBER: GA121487

SAMPLE NO. : 0002

INVOICE JOB #: C71928

**LOCATION #: 63120** 

**IDENTIFICATION** 

CAN NURMER 2442

SERUBBER ( RUN#1

	AS RECEIVED BASIS	AIR DRIED BASIS	DRY Basis
	The second of the second of the second of		
% MOISTURE	15.90	5.21	
% ASH	4.51	5.08	5.30
≈ VOLATILE	29.69	33.46	35.30
% FIXED CARBON	49.90	56.25	59.34
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR	0.74	0.83	0.88
BTU/LB.	11,439	12,893	13,602
MAF BTU/LB.	And the same start	mg, and com	14,372
LBS SULFUR/MM BTU	0.65		
LRS WATER/MM BTU	13.90		
LBS ASH/MM BTU	3.94		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED,

KEVIN J. WEIL



CORE LABURATORIES, INC.

ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSUILLE, IN 47712 (812) 424-2909

17-DEC-87

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.R., 46971-500

FILE NUMBER: GA121087 SAMPLE NO. : 0001

**IDENTIFICATION** 

CAN NUMBER 2388

INVOICE JOB #: 071928

(BOILER #3) SCRUBBER S

LOCATION #: 63120

	AS RECEIVED BASIS	AIR DRYED BASIS	DRY Basis
% MOISTURE % ASH % VOLATILE % FIXED CARBON	15.76 5.33 30.79 48.12	3.16 6.13 35.40 55.32	6.33 36.55 57.12
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR BTU/LB. MAF BTU/LB.	0.75 11,409	0.86 13,116 	0.89 13,544 14,458
LBS SULFUR/HM BTU LBS WATER/MM BTU LBS ASH/MM BTU	0.66 13.81 4.67		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED;



# Vestern Atles Thermational CORE LABORATORIES, INC.

#### ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSVILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971-500

FILE NUMBER: GA121587

SAMPLE NO. : 0001

INVOICE JOB #: C71928

LOCATION #: 63120

IDENTIFICATION

CAN \$3648
(BOILER#3)
SCRUBBER
RUN#3

	AS RECEIVED BASIS	AIR DRIED DASIS	DRY Basis
% MOISTURE	15.41	3.54	
% ASH	5.30	6.04	6.26
% VOLATILE	31.00	35.35	36.65
% FIXED CARBON	48.29	55.07	57.09
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR	0.73	0.83	0.86
RTU/LB.	11,474	13,084	13,564
MAF BTU/LB.		gan 1 man 140	14,465
LRS SULFUR/MM RTU	0.64		
LBS WATER/MM BTU	13.43		
LBS ASH/MM BTU	4.62		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SURMITTED,

KEVIN J. WEIL



# CORE LABORATORIES, INC.

U. LUI ANNO DE LA CONTRACTOR DEL CONTRACTOR DE LA CONTRACTOR DE LA CONTRACTOR DE LA CONTRAC

ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSVILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT, OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971-500

FILE NUMBER: GA121587

SAMPLE ND. : 0002

INVOICE JOB #: C71928

LOCATION #: 63120

**IDENTIFICATION** 

CAN #3872 (BON-ER#4) BYPMSS (RUN# 1)

	AS RECEIVED BASIS	AIR DRIED Basis	DRY Rasis
		and any that the sale and are not not	
% MOISTURE	18.97	5.09	W. p
Z ASH	5.65	6.42	6.97
Z VOLATILE	29.00	33.97	35.79
% FIXED CARBON	46.38	54.33	57.24
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR	0.97	1.14	1.20
BTU/LB.	10,834	12,689	13,370
MAF BTU/LB.	ant of the ones.		14,371
LBS SULFUR/MM BTU	0.90		
LBS WATER/MM BTU	17.51		
LBS ASH/MM RTU	5.21		

ASH SOFTENING TEMP: 2590 DEGREE F.

RESPECTFULLY SUBMITTED,

KEVIN J. WEIL



# CORE LABORATORIES, INC.

#### ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSVILLE, IN 47712 (812) 424-2909

17-DEC-87

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.R., IN 46971-500

FILE NUMBER: GA121087

SAMPLE NO. : 0004

INVOICE JOB 4: C71928

LOCATION 4: 63120

IDENTIFICATION

CAN NUMBER 2448

BOILER# 47 BYPASS BIN#2

	AS RECEIVED	AIR DRIED	DRY
	BASIS	BASIS	Basis
% MOISTURE	16.36	4.80	
% ASH	5.52	6.28	6.60
% VOLATILE	30.10	34.26	35.99
% FIXED CARBON TOTAL PERCENTAGE	48.02	54.65	57.41
	100.00	100.00	100.00
% SULFUR BTU/LB. MAF BTU/LB.	0.74 11.302	0,84 12,861 	0.88 13,513 14:467
LBS SULFUR/MM BTU LBS WATER/MM BTU LBS ASH/MM BTU	0.65 14.47 4.88		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED,

KEVIN J. WEIL



# CORE LABORATORIES, INC.

## ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSVILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971-500

FILE NUMBER: GA121487

SAMPLE NO. : 0004

INVOICE JOB #: C71928

LOCATION #: 63120

IDENTIFICATION

CAN NUMBER 29

SOILER#47
BYPASS

RUN#3

	AS RECEIVED	AIR DRIED	DRY
	BASIS	BASIS	Basis
% MOISTURE	15.08	4.95	6.32
% ASH	5.37	6.01	
% VOLATILE	30.21	33.82	35.58
% FIXED CARBON	49.34	55.22	58.10
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR RTU/LR. MAF BTU/LR.	0.74 11,464	0.83 12,832	0.87 13,500 14,410
LRS SULFUR/MM BTU LRS WATER/MM BTU LRS ASH/MM BTU	0.65 13.15 4.68		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SURMITTED,

Kevin J. Weil



# CORE LABORATORIES, INC.

#### ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSUILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.R., IN 46971-500

FILE NUMBER: GA121587

SAMPLE NO. : 0004

INVOICE JOB #: C71928

LOCATION #: 63120

IDENTIFICATION

CAN #3035

(BONER # 4) SCRUBBER RUN#1)

	AS RECEIVED BASIS	AIR DRIED BASIS	DRY Basis
		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
% HOISTURE	16.66	3.95	
% ASH	5.33	6.15	6.40
% VOLATILE	29.97	34.54	35.96
	48.04	55.36	57.64
		<b>•</b> ••••	
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR	0.73	0.85	0.88
RTU/LR.	11,334	13,063	13,600
MAF BTU/LB.			14,529
LBS SULFUR/MM BTU	0.64		
LBS WATER/MM BTU	14.70		
LRS ASH/MM BTU	4.70		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED,

Revin J. Weil



# ternational CORE LABORATORIES, INC.

ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSVILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971~500

FILE NUMBER: GA121587

SAMPLE NO. : 0003

INVOICE JOR #: C71928

LOCATION #: 63120

**IDENTIFICATION** 

CAN \$4264 (BOLER#47) SCRUBER RUN#2)

	AS RECEIVED BASIS	AIR DRIED BASIS	DRY Basis
	May your mark that have vapor agent from white destr. An	ne har res ann ann an der tau ma	
% MOISTURE	16.47	2.46	-
% ASH	5.23	6.11	6.26
% VOLATILE	30.64	35.78	36.68
% FIXED CARBON	47.66	55.66	57.06
TOTAL PERCENTAGE	100.00	100.00	100.00
z SULFUR	0.71	0.83	0.85
BTU/LB.	11,356	13,261	13,595
MAF BTU/LB.			14,502
LRS SULFUR/MM BTU	0.63		
LBS WATER/MM BTU	14.50		
LBS ASH/MM BTU	4.61		

ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED,

KEVIN J. GEIL



**IDENTIFICATION** 

## CORE LABORATORIES, INC.

#### ANALYTICAL REPORT

2315 GLENVIEW AVE. EVANSUILLE, IN 47712 (812) 424-2909

04-JAN-88

DEPT. OF THE AIR FORCE 305 CSG/DE GRISSOM A.F.B., IN 46971-500

FILE NUMBER: GA121487 SAMPLE NO.: 0003 INVOICE JOB #: C71928

LOCATION #: 63120

CAN NUMBER 8624

BOLER#4 SERUBBER RUN#3

	AS RECEIVED PASIS	AIR DRIED BASIS	DRY Basis
% MOISTURE	15.19	3.74	
% ASH	5.44	٥.18	5.42
% VOLATILE	30.06	34.11	35.44
% FIXED CARBON	49.31	55.97	58.14
	<del>-</del>		
TOTAL PERCENTAGE	100.00	100.00	100.00
% SULFUR	0.73	0.83	0.86
BTU/LB.	11,495	13,047	13,554
MAF BTU/LB.			14,484
LBS SULFUR/MM BTU	0.64		
LBS WATER/MM BTU	13.21		
LRS ASH/MM BIU	4.73		

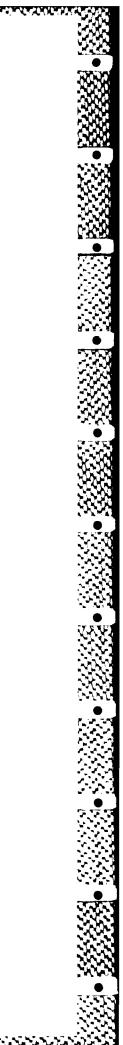
ASH SOFTENING TEMP: 2700+ DEGREE F.

RESPECTFULLY SUBMITTED,

KEVIN J. WEIL

APPENDIX E

Boiler 3, Bypass Stack



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**********************

SOURCE TEST REPORT

SOURCE:

GRISSOM AFB CENTRAL HEATING PLANT

GRISSOM AFB, IN 46971

DEVICE TESTED : BOILER #3:BYPASS STACK

DATE TESTED: 18-20 NOV 87

SUBMITTING AGENCY: USAFOEHL/ECQ

BROOKS AFB, TX 78235

# DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: BYPHSS Stack diameter at ports: 5.5 (ft)

Distance A (ft) //.5 (duct diameters) 2./

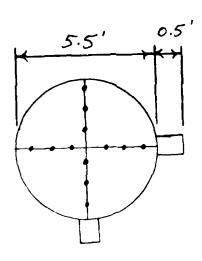
Recommended number of traverse points as determined by

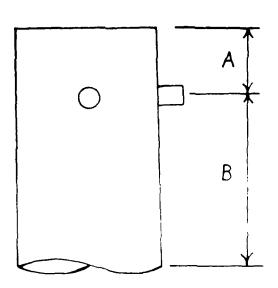
distance A: 12

Distance B (ft) 39.5 (duct diameters) 7.2Recommended number of traverse points as determined by

distance B: 12

Number of traverse points used: 12





************************

## TEST TRAVERSE POINT LOCATION

STACK DIAM. (IN.) = 66 STACK RADIUS (IN.) = 33 STACK DIAM. (FT.) = 5.5 STACK AREA (SQ.FT) = 23.75828

POINT #	DISTANCE IN
1	2.875261
2	9.665478
3	19,52781
4	46.4722
5	56.33452
6	63.12474

THE ABOVE DISTANCES PROCEED FROM THE TEST PORT ACROSS THE TRAVERSE TO THE OPPOSITE WALL OF THE STACK.
THESE DISTANCES SHOULD BE ROUNDED OFF TO THE NEAREST 1/4 INCH.
THAT'S ABOUT AS ACCURATE AS YOU CAN GET WITH AN EPA METHOD 5 PROBE.

# STANDARD CONDITIONS (TEMP. AND PRESSURE)

STD.TEMP (F) = 68 STD.TEMP (R) = 528 STD. PRESSURE (IN.HG) = 29.92 ***********

***** RUN #1 *****

#### HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 279.2611
AMBIENT WET BULB (K) = 276.4833
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 31.467 DEG. F. VAPOR PRESSURE (IN.HG) = .1766514 SATURATION VAPOR PRESS. (IN.HG) = .2770307 RELATIVE HUMIDITY (%) = 63.76599 SPECIFIC HUMIDITY (pp1000) = 3.792975

#### METER DATA PROGRAM

# OF TEST POINTS = 12 AMBIENT PRESS. (IN.HG) = 29.42

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	47	47	47	1.88
2	49	47	48	1.69
3	53	48	50.5	2.08
4	56	49	52.5	1.9
5	57	50	53.5	1.33
6	57	50	53.5	1.52
7	51	51	51	1.13
8	50	50	50	1.32
9	52	50	51	1.7
10	55	50	52.5	2.09
11	57	51	54	2.28
12	58	51	54.5	1.71

FINAL AVG. METER TEMP (R) = 511.5 DELTA H@ VALUE = 2.11

FINAL AVG. METER PRESS. (IN.HG) = 29.54641

********************

## H20 TEST DATA

START METER READING = 41.3
END METER READING = 77.093
TOTAL CONDENSATE VOL (ML) = 50.08
H20 VAPOR GAS VOLUME @ STP = 2.373792
TOTAL METER GAS VOL (uncorrected CF) = 35.793
AVG. METER TEMP (R) = 511.5
TOTAL DRY SAMPLE VOL (CF @ STP) = 36.48628
MOLE FRACTION DRY AIR = .9389143
% H20 BY VOL = 6.108565

#### GAS DENSITY

% CO2 = 10.17

% 02 = 9.37

% CO = 0

% N2 = 78

GAS DENSITY = .9886743

DRY MOL. WT. = 29.3132

## *************

## SOURCE TEST DATA

NOZZLE DIAM (IN.) = .498 NOZZLE AREA (FT2) = 1.352651E-03 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 29.42 STACK PRESS (IN.HG) = 29.4237 TEST START TIME = 1437

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H2O	TIME MINS
1 / .05	880 / 507	16.38736	1.88	5
2 / .045	880 / 508	15.54642	1.69	5
3 / .055	880 / 510.5	17.18721	2.08	5
4 / .05	880 / 512.5		1.9	5
5 / .035	880 / 513.5	13.71065	1.33	5
6 / .04	880 / 513.5	14.6573	1.52	5
7 / .03	880 / 511	12.6936	1.13	5
8 / .035	880 / 510	13.71065	1.32	5
9 / .045	880 / 511	15.54642	1.7	5
10 / .055	880 / 512.5	17.18721	2.09	5
11 / .06	880 / 514	17.95146	2.28	5
12 / .045	880 / 514.5	15.54642	1.71	5

TOTAL METER VOLUME = 35.793

AVG. STACK TEMP (R) = 880

AVG. STACK VEL (FT/SEC) = 15.54267

AVG. STACK VEL (FT/MIN) = 932.5603

AVG. METER TEMP (R) = 511.5

AVG. METER DELTA H (IN.H20) = 1.719167

AVG. METER PRESSURE (IN.HG) = 29.54641

TOTAL MINS OF TEST = 60

STACK ACFM = 22156.02

STACK DSCFM = 12272.98

************

# ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 50.08

AVERAGE STACK TEMPERATURE (R) = 880

TOTAL METER GAS VOL (uncorrected CF) = 35.793

AVG METER TEMP (R) = 511.5

BAROMETRIC PRESSURE (IN.HG) = 29.42

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 1.719167

AVG. STACK VEL (FT/MIN) = 15.54267

STACK PRESSURE (IN.HG) = 29.4237

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 1.352651E-03

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 93.70332 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0

FINAL FILTER WT. (GMS) = .2719

SAMPLE WT. (GMS) = .2719

SAMPLE VOL. (DSCFM) = 36.48628

CONCENTRATION (GR/DSCF) = .1149862

% CO2 = 10.17

CONCENTRATION @ 12% CO2 (GR/DSCF) = .1356769

STACK DSCFM = 12272.98

PM EMISSIONS (stk conds) (LB/HR) = 12.09559

PM EMISSIONS (@ 12% CO2) (LB/HR) = 14.27209

****************

**** RUN # 2 *****

#### HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 279.8167
AMBIENT WET BULB (K) = 277.8722
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 36.48698 DEG. F.
WAPOR PRESSURE (IN.HG) = .2154221
SATURATION VAPOR PRESS. (IN.HG) = .2877726
RELATIVE HUMIDITY (%) = 74.85843
SPECIFIC HUMIDITY (pp1000) = 4.627782

#### METER DATA PROGRAM

" OF TEST POINTS = 12
AMBIENT PRESS. (IN.HG) = 29.387

POINT #	TEMP IN	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
π	г	r	Γ	14.1120
1	53	50	51.5	1.4
2	52	50	51	1.4
3	<b>5</b> 5	51	53	1.6
4	57	50	53.5	2.01
5	58	52	55	2.01
6	59	53	56	2.01
7	51	51	51	1.4
8	51	50	50.5	1.6
<b>9</b>	52	50	51	2.01
10	51	50	50.5	1.99
11	56	51	53.5	1.6
12	58	51	54.5	1.2

FINAL AVG. METER TEMP (R) = 512.5833 CELTA HO VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 29.51096 **********************

## H2O TEST DATA

START METER READING = 77.441
END METER READING = 112.782
TOTAL CONDENSATE VOL (ML) = 60.34
H20 VAPOR GAS VOLUME @ STP = 2.860116
TOTAL METER GAS VOL (uncorrected CF) = 35.341
AVG. METER TEMP (R) = 512.5833
TOTAL DRY SAMPLE VOL (CF @ STP) = 35.90624
MOLE FRACTION DRY AIR = .9262217
% H20 BY VOL = 7.377831

## GAS DENSITY

% CO2 = 10.67 % O2 = 8.07 % CO = 0 % N2 = 78

GAS DENSITY = .9774436

DRY MOL. WT. = 29.1172

# *******************

#### SOURCE TEST DATA

NOZZLE DIAM (IN.) = .498 NOZZLE AREA (FT2) = 1.352651E-03 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 29.387 STACK PRESS (IN.HG) = 29.3936 TEST START TIME = 1002

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H20	TIME MINS
1 / .035	878 / 511.5	13.78057	1.4	5
2 / <b>.</b> 035 3 / <b>.</b> 04	878 / 511 887 / 513		1.4 1.6	5 5
4 / .05	897 / 513.5		2.01	5
5 / .05	892 / 515	16.60172	2.01	5
6 / .05	892 / 516	16.60172	2.01	5
7 / <b>.</b> 035	880 / 511	13.79625	1.4	5
3 / .04	883 / 510.5	14.77393	1.6	5
9 / .05	885 / 511	16.53645	2.01	5
10 / .05	891 / 510.5	16.59242	1.99	5
11 / .04	891 / 513.5	14.84071	1.6	5
1.2 / <b>.</b> 03	880 / 514.5	12.77285	1.2	5

TOTAL METER VOLUME = 35.341

AVG. STACK TEMP (R) = 886.1667

AVG. STACK VEL (FT/SEC) = 15.12773

AVG. STACK VEL (FT/MIN) = 907.6636

AVG. METER TEMP (R) = 512.5833

AVG. METER DELTA H (IN.H20) = 1.685834

AVG. METER PRESSURE (IN.HG) = 29.51096

TOTAL MINS OF TEST = 60

STACK ACFM = 21564.52

STACK DSCFM = 11688.72

# ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 60.34

AVERAGE STACK TEMPERATURE (R) = 886.1667

TOTAL METER GAS VOL (uncorrected CF) = 35.341

AVG METER TEMP (R) = 512.5833

BAROMETRIC PRESSURE (IN.HG) = 29.387

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 1.685834

AVG. STACK VEL (FT/MIN) = 15.12773

STACK PRESSURE (IN.HG) = 29.3936

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 1.352651E-03

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 96.71302 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = .3003
SAMPLE WT. (GMS) = .3003
SAMPLE VOL. (DSCFM) = .35.90624
CONCENTRATION (GR/DSCF) = .129048
% CO2 = 10.67
CONCENTRATION @ 12% CO2 (GR/DSCF) = .1451337
STACK DSCFM = 11688.72
PM EMISSIONS (stk conds) (LB/HR) = 12.92855
PM EMISSIONS (@ 12% CO2) (LB/HR) = 14.54007

***********

***** RUN # 3 *****

#### HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 272.5944

AMBIENT WET BULB (K) = 270.3722

SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 19.01367 DEG. F.
VAPOR PRESSURE (IN.HG) = .1060571
SATURATION VAPOR PRESS. (IN.HG) = .1733842
RELATIVE HUMIDITY (%) = 61.16885
SPECIFIC HUMIDITY (pp1000) = 2.275113

#### METER DATA PROGRAM

# OF TEST POINTS = 12 AMBIENT PRESS. (IN.HG) = 29.2

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	38	36	37	1.54
2	39	37	38	1.93
3	41	37	39	1.93
4	42	37	39.5	1.93
5	42	37	39.5	1.16
6	42	38	40	1.16
7	37	36	36.5	1.16
8	38	37	37.5	1.54
9	39	36	37.5	1.54
10	39	36	37.5	1.93
11	40	36	38	1.74
12	38	35	36.5	1.59

FINAL AVG. METER TEMP (R) = 498.0417 DELTA H@ VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 29.31734 ********************

# H2O TEST DATA

START METER READING = 113.276
END METER READING = 147.475
TOTAL CONDENSATE VOL (ML) = 56.75
H20 VAPOR GAS VOLUME @ STP = 2.68995
TOTAL METER GAS VOL (uncorrected CF) = 34.19901
AVG. METER TEMP (R) = 498.0417
TOTAL DRY SAMPLE VOL (CF @ STP) = 35.52587
MOLE FRACTION DRY AIR = .9296116
% H20 BY VOL = 7.03884

#### GAS DENSITY

% CO2 = 10.1 % O2 = 8.53 % CO = 0

% N2 = 78

GAS DENSITY = .9754186

DRY MOL. WT. = 29.0136

******************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .498 NOZZLE AREA (FT2) = 1.352651E-03 PITOT FACTOR = .84 ATM('S. PRESS (IN.HG) = 29.2 STACK PRESS (IN.HG) = 29.205 TEST START TIME = 855

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H2O	TIME MINS
# / IN.HZU	N.	11/366	IN.HZU	MINS
1 / .04	885 / 497	14.85373	1.54	5
2 / .05	911 / 498	16.84915	1.93	5
3 / .05	920 / 499	16.93218	1.93	5
4 / .05	919 / 499.5	16.92297	1.93	5
5 / .03	887 / 499.5	12.87824	1.16	5
6 / .03	879 / 500	12.82003	1.16	5
7 / .03	885 / 496.5	12.86371	1.16	5
8 / .04	890 / 497.5	14.89563	1.54	5
9 / .04	901 / 497.5	14.9874	1.54	5
10 / .05	904 / 497.5	16.78429	1.93	5
11 / .045	901 / 498	15.89654	1.74	5
12 / .04	890 / 496.5	14.89563	1.59	5

TOTAL METER VOLUME = 34.19901
AVG. STACK TEMP (R) = 897.6667
AVG. STACK VEL (FT/SEC) = 15.13163
AVG. STACK VEL (FT/MIN) = 907.8975
AVG. METER TEMP (R) = 498.0417
AVG. METER DELTA H (IN.H20) = 1.595833
AVG. METER PRESSURE (IN.HG) = 29.31734
TOTAL MINS OF TEST = 60
STACK ACFM = 21570.08
STACK DSCFM = 11510.48

************

# ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 56.75

AVERAGE STACK TEMPERATURE (R) = 897.6667

TOTAL METER GAS VOL (uncorrected CF) = 34.19901

AVG METER TEMP (R) = 498.0417

BAROMETRIC PRESSURE (IN.HG) = 29.2

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 1.595833

AVG. STACK VEL (FT/MIN) = 15.13163

STACK PRESSURE (IN.HG) = 29.205

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 1.352651E-03

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 97.20239 %

# PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0

FINAL FILTER WT. (GMS) = .3812

SAMPLE WT. (GMS) = .3812

SAMPLE VOL. (DSCFM) = 35.52587

CONCENTRATION (GR/DSCF) = .1655671

% CO2 = 10.1

CONCENTRATION @ 12% CO2 (GR/DSCF) = .1967134

STACK DSCFM = 11510.48

PM EMISSIONS (stk conds) (LB/HR) = 16.33424

PM EMISSIONS (@ 12% CO2) (LB/HR) = 19.40702

***** END OF ANALYSIS FOR RUN # 3 ****** 69

Shows seemed stack cross section equivalent of the seemed stack cross section of the seemed stack cross seemed stack cro		4													
	RUN NUMBER	7	5	CHEMAT	FIC OF STACK	CROSS S	ECTION	EQUATIONS				AMBIE			
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7	POINT	T.ME (min)	PRESS (10 H.	URE 201/AC	(oF)	Ts) oR)	HE AD (Vp)	PRESS.	SAMPLE VOLUME (Q) (f)	N (R)	AVG (Tm)	00T	BOX TEMP (OF)	OUTLE TEMP	<b>⊢</b> ^
5.4720 0.055 7.09 5.65 1.4 3.4 3.4 3.4 3.4 3.4 3.4 3.4 3.4 3.4 3	14		50,	5.1	07.4		200	881	11.300	47	17	77	270	44	-
16 51430 0055 2198 575 505 47 248  22 6" 430 0035 705 71 51 51 50 51 77 348  24 6" 420 0035 705 71 51 51 51 51 51 51 51 51 51 51 51 51 51	ξX			11.14	420		0,045	1.01			84	44		49	
1,5   6"   430   0.055   1,90   51   51.5   49   31.1     2,0   6"   4.20   0.055   1.31   52.8   57   53.5   50   2.7     2,0   6"   4.20   0.055   1.31   6.2   50   50   50   50     10   6   4.20   0.055   1.31   6.2   50   50   50     10   6   4.20   0.055   1.31   6.2   50   50   50     10   6   4.20   0.055   1.31   6.2   50   50   50     2,0   9   4.20   0.055   1.30     4,120   0.055   1.30   1.30     4,120   0.055   1.30   1.30     4,120   0.055   1.30     4,120   0.055   1.30     4,130   0.055   1.30     4,130   0.055   1.30     4,130   0.055   1.30     4,130   0.055   1.30     5,130   0.055   1.30     6,130   0.055   1.30     6,130   0.055   1.30     6,130   0.055   1.30     6,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055   1.30     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130   0.055     7,130	7	1/0		5.1	430°		0.055	2.08		5/3	50.5	187	248	43	
25 6 420 0035 405 57.8 57.8 57.0 37!  25 6 420 0055 1/32 62 50 50 50 50  10 6 420 0055 1/32 62 50 50 50  10 6 420 0055 1/32 62 50 50  10 6 420 0055 1/32 62 50 50  10 6 420 0055 1/32 62 50  10 6 420 0055 1/32 62 50  10 6 420 0055 1/32 62 50  10 6 420 0055 1/32 62 50  10 6 420 0055 1/32 62 50  10 75 75 50  10 75 75 50  10 75 75 50  10 75 75 50  10 75 75 75 75  10 75 75 75  10 75 75 75  10 75 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75 75  10 75	Y	5,		6"	430		,00	7.90	5/10		\$2,5	49	267	$b$ , $\mathcal{F}$	
16 1 545		1/2		9	7/0/6	55	N. C. S.		1	12	.,	S.	37/	, ,	
7. 1 545	77	3	+	3	No.	1	100	177	]		53.0		7//	7	
2 5 6 62 50 62 50 371 2 6 720 00.55 7.70 6.0.5 5.0.5 5.0 375 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5		1545		V	$\gamma_{k}$		0.03	2//		i	15			XX	
10 6 720 0045 170 6.86 52 51 50 37.5 30 9 420 0045 1.77 525 54 51 27.5 10 25 12 22 54 51 27.5 10 25 12 22 54 51 27.5 10 25 12 27.5 10 25		7		7	420		2055	1,32	62	97	50	07	17	212	
20	t'n	707		E	130		0045	02.7		-	15	250	275	24	
1	مار	7,2		34	120		1055	2.03	6.8.6	4	52.5	20	10	54	
16/5 56 34.5 5/ 24/5 16/5	1	1)50		7	230		0,000	12.00		57	154	7	1778	2,/	
41,360 35.793	<b>C</b>	7/1/		3	700		2045	////	001110	3	54.5	3	27/5	12/	
35.793									41.300						
25.7.7 4 4 4 74174.									79						
241F4.						1			35.17						
241F4.						7				_					
2914.						F									
7.1							,	1			5/5				
								1.72							

	AH ui	0 d d d	i (Fd)	IMPINGED CUTLET TEMP (PF)	(2)		*	27	31.7%				
	SON PRESS	PROBE HEATER SETTING PROBE LENGTH  NOZZLE AREA (A)	DRY GAS FRACTION (Fd)	SAMPLE BOY TEMP (°F)	7-5	1.5	1231	1.30	12.5	27:72			
	STATION STATION		0 7 9 0	R TEMP OUT (°F)	<del></del>	7	500	4.7	100	200	<u> </u>		
	ر ب	325 22 Ars		GAS METER AVG (Tm) (OR)		39.5	k.  -	38.	37.5				
SHEET	NS	x 2	2	GAS SAMPLE IN VOLUME (cu ft)	237	<i>i</i> 5.	1 1	130,519 3	1117 4	300	67.47.5	1.5.	34.1.40
PARTICULATE SAMPLING DATA SHEET	PRINCE OF $+460$ $+460$ $+460$ $+460$ $+460$ $+460$	100 to 2005	# : J () + ()	ORIFICE DIFF. PRESS. (H)	1,54	614	2/7	111	1200	757		17	11
RTICULATE SA	SECTION			VELOCITY HEAD (Vp)	000	0.00	200	2007	0000	0.000	#,71	0000	0.055
PAI	SCHEWATIC OF STACK CROSS SECTION  KILLER OF THRE  O. 2799 M.	A. T.		(OF) (OR)	25		4/1		000 117	2,0	7 7/2	· 1/2	2000
	SCHEMATIC OF 1812 197 7 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			GTAT PESSU	12		,	1-3			7		41,7
	200	6 ( 55 ) 1   1   1   1   1   1   1   1   1   1		SAMPLING TIME (min)	77		3 0	36	27		34		81
	FLANT	TAMBIF TO CH	1.)	TRAVERSE POINT NIMBER	1 1	77.							OEHL FORM

, 72 ::

BASE Boiler Griston	<u>3</u>	18 Now			H /			
BUILDING NUMBER	saa Pur		SOURCE NUME	BER				
		PARTICUI FINAL WE		INITIAL	WEIGHT	WEIGHT	PARTICLES	
	TEM	(gm)			gan)		<b>ý</b> m)	
FILTER NUMBER	#1	0.5.	137	0.0	2717	0,2	420	
ACETONE WASHINGS Hall Filter)	(Probe, Front	105.	1850	105.	.1551	0.2%	ې ژ	
BACK HALF (If need)	ed)							
		Total We	ght of Particul	lates Collect	ed .	0.2	719	
11.		WATE				·		
	TEM	FINAL WE	IGHT		WEIGHT	_	T WATER	
IMPINGER 1 (H20)		129	?	10	)	29	·	
IMPINGER 2 (H20)		110		100		10		
IMPINGER 3 (Dry)		/		Õ		/		
1MPINGER 4 (SIIIca Gal) + 237,7 + 270,24,3		216,	4	206.32		10.08		
	Total We	ight of Water C	Collected		10.08° am			
III.	ANALYSIS	GASES ANALYSIS	GASES (Dry)				S AVERAGE	
ITEM	1	2		ANALYSIS ANALY		AVERAGE		
VOL % CO2	10.05	10.2	10.0	0.25		/1	1.17	
VOL % 02	9,2	7,3	9,6			9	37	
VOL % CO								
VOL % N2								
	·•·	Vol & N2 = (100% - %	CO2 . * O2 . ·	<b>S</b> CO)		., <b>-                                   </b>		
AMD FEB 84 651	REPLACES SEHE 20, 1	MAY TALAN HARF TAS	73					

	AIR POLL	JTION PARTICU	LATE ANA	LYTICAL	DATA		
BASE		* LIM)			RUN NUMBER	ζ	
BUILDING NUMBER			SOURCE NO	IMBER			
coilens	Run#2	Bycass	<u> </u>				
<u>                                     </u>		O' PARTIC	ULATES	<del> </del>	<del></del>	<del></del>	
	TEM	FINAL Y			AL WEIGHT (gm)	*	EIGHT PARTICLES (gm)
SILTER NUMBER	d & filter	0,83	109		2755		2.2808
ACETONE WASHINGS Half Filter)	(Probe, Fmnt	97,6	224	77,	6029	(	1.0195
BACK HALF (If neede	d)		<u>.</u>				
		Total W	eight of Partic	culates Colle	octed		3003 em
11.		WA	TER	·		<b>,</b>	:
17	TEM	FINAL V		INIT	AL WEIGHT		WEIGHT WATER (gm)
IMPINGER 1 (H20)		13	6	10	0	ئ	C
IMPINGER 2 (H20)		1/2		100		1/	2
IMPINGER 3 (Dn/)	1		0			/	
IMPINGER 4 (Silice Ge	"Tare 21.3	65 213	,35	20	7.01	/	1-34
100 JCK 0.5	218.3	5 Total W	Total Weight of Water Collected				00,34 em
111.	y	GASE	\$ (Dry)		T		
ITEM	ANALYSIS 1	ANALYSIS 2	ANA	LYSIS 3	ANALYSIS 4		AVERAGE
VOL % CO ₂	10.6	10.6	10,	.8			,
VOL % 02	8.0	8.0	10.	2			- 1 7
VOL * CO							
VOL - N2							
		Vol 5 N2 = (1005 - 1	s co ₂ . s o ₂	• <b>\$</b> CO)			

	AIR POL	LUTIO	N PARTICUL	ATE ANA	LYTICAL	DATA			
Boile 3  Gypass  Bilding nymber	Run 3	DATE	2 Jellan)		F	H 3			
BLILDING NUMBER				SOURCE NU	MBER				
ı.			PARTICU		T				
l'	TEM		FINAL WE	.IGHT	INITI	AL WEIGHT (gm)	WEI	GHT PARTICLI (gm)	
FILTER NUMBER	#3		0.644	16	0.	2799	0	3647	
ACETONE WASHINGS Half Filter)	(Probe, Front		98,84	91	98.	8326		0165	
BACK HALF (If neede	d)								
			Total Wel	ght of Partic	ulates Colle	cted	.3	812	
II.			WATE						
l'	TEM		FINAL WE	IGHT	INITI	AL WEIGHT	`	WEIGHT WATER	
IMPINGER 1 (H20)			138		10	0		38	
IMPINGER 2 (H20)			109		100			9	
IMPINGER 3 (Dry)			/	1 0			/		
IMPINGER 4 (SIIIca Ge	IMPINGER 4 (SIIIca Goi) 237.35 thre 31.3			218.05		209.30		8:15	
100 wt			Total We	ight of Water	Collected		50	6.75	
III. 25 -> ,5	ANALYSIS		GASES ANALYSIS	T	L YSIS	ANALYSIS		AVERAGE	
	1	+	2	9	<u>,</u>	4			
VOL % CO ₂	10,4	/	10,2	10,	2	10.2	?	10.1	
VOL % 02	8-8	C	8,7	8.	5	8.4		<b>\$53</b>	
VOL : CO									
VOL " N2									

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APPENDIX F

Boiler 3, Scrubber Stack

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SOURCE TEST REPORT

SOURCE:

GRISSOM AFB CENTRAL HEATING PLANT

GRISSOM AFB, IN 46971

DEVICE TESTED : BOILER #3:SCRUBBER STACK

DATE TESTED : 23 NOV 87

SUBMITTING AGENCY :

USAFOEHL/ECQ

BROOKS AFB, TX 78235

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#### DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID:  $\frac{SCRUBBER}{STACKB}$  Stack diameter at ports:  $\frac{5.0}{}$  (ft)

Distance A (ft) 7.0 (duct diameters) 1.4

Recommended number of traverse points as determined by

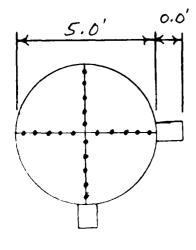
distance A: 20

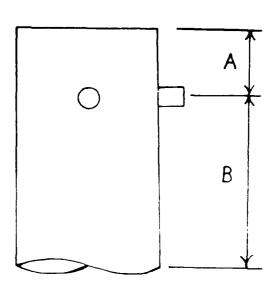
Distance B (ft)  $\frac{28}{}$  (duct diameters)  $\frac{5.6}{}$ 

Recommended number of traverse points as determined by

distance B: 20

Number of traverse points used: 20





# TEST TRAVERSE POINT LOCATION

STACK DIAM. (IN.) = 60 STACK RADIUS (IN.) = 30 STACK DIAM. (FT.) = 5 STACK AREA (SQ.FT) = 19.63494

POINT	#	DISTANCE IN
1		1.539501
2		4.9002
3		8.786797
4		13.56832
5		20.51317
6		39.48683
7		46.43168
8		51.21321
9		55.0998
10		58.4605

THE ABOVE DISTANCES PROCEED FROM THE TEST PORT ACROSS THE TRAVERSE TO THE OPPOSITE WALL OF THE STACK.

THESE DISTANCES SHOULD BE ROUNDED OFF TO THE NEAREST 1/4 INCH. THAT'S ABOUT AS ACCURATE AS YOU CAN GET WITH AN EPA METHOD 5 PROBE.

# STANDARD CONDITIONS (TEMP. AND PRESSURE)

STD.TEMP (F) = 68 STD.TEMP (R) = 528 STD. PRESSURE (IN.HG) = 29.92 **************

***** RUN # 1 *****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 280.9278
AMBIENT WET BULB (K) = 279.2611
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 39.89329 DEG. F.
VAPOR PRESSURE (IN.HG) = .2459105
SATURATION VAPOR PRESS. (IN.HG) = .3103822
RELATIVE HUMIDITY (%) = 79.22828
SPECIFIC HUMIDITY (pp1000) = 5.28485

#### METER DATA PROGRAM

# OF TEST POINTS = 20 AMBIENT PRESS. (IN.HG) = 29.02

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	47	<b>4</b> 7	47	1.84
2	50	<b>4</b> 8	49	2.14
3	52	48	50	2.53
4	55	49	52	2.78
5	57	49	53	3.21
3 4 5 6 7	59	50	54.5	3.32
7	61	51	56	3.23
8	61	51	56	3.14
9	63	53	58	3.15
10	63	53	58	2.36
11	63	54	58.5	2.16
12	62	55	58.5	2.36
13	63	55	59	2.46
14	64	55	59.5	2.67
15	65	56	60.5	3.19
16	66	57	61.5	3 <b>.2</b> 8
17	66	57	61.5	3.38
18	67	58	62.5	3 <b>.2</b> 8
19	67	58	62.5	3.47
20	67	58	62.5	2.67

FINAL AVG. METER TEMP (R) = 517
DELTA H@ VALUE = 2.11
FINAL AVG. METER PRESS. (IN.HG) = 29.22816

# H2O TEST DATA

START METER READING = 380.784
END METER READING = 428.108
TOTAL CONDENSATE VOL (ML) = 80.8
H20 VAPOR GAS VOLUME @ STP = 3.82992
TOTAL METER GAS VOL (uncorrected CF) = 47.32401
AVG. METER TEMP (R) = 517
TOTAL DRY SAMPLE VOL (CF @ STP) = 47.21335
MOLE FRACTION DRY AIR = .9249672
% H20 BY VOL = 7.503282

# GAS DENSITY

% CO2 = 3.37 % O2 = 16.83 % CO = 0 % N2 = 78

GAS DENSITY = .9639005

DRY MOL. WT. = 28.7084

# ******************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .313 NOZZLE AREA (FT2) = 5.343376E-04 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 29.02 STACK PRESS (IN.HG) = 29.028 TEST START TIME = 830

PT/DELTA P # / IN.H20		VELOCITY FT/SEC	DELTA H IN.H2O	TIME MINS
1 / .19	570 / 507	26.2145	1.84	3
2 / .22	571 / 509	28.23299	2.14	3
3 / .26	571 / 510	30.69249	2.53	3
4 / .3	571 / 512	32.96902	2.78	3
5 / .33	574 / 513	34.66892	3.21	3
6 / .34	575 / 514.5	35.22093	3.32	3
7 / .33	574 / 516	34.66892	3.23	3
8 / .32				3
9 / .32	573 / 518	34.10984	3.15	3 3 3 3 3 3 3 3
10 / .24	574 / 518	29.56575	2.36	3
11 / .22	574 / 518.5	28.30706	2.16	3
12 / .24	574 / 518.5			
13 / .25	574 / 519	30.17542	2.46	3
14 / .27	573 / 519.5	31.33189	2.67	3
15 / .32	570 / 520.5	34.02043	3.19	3
16 / .33	572 / 521.5	34.60847	3.28	3
17 / .34	572 / 521.5	35.12893	3.38	3
18 / .33	573 / 522.5	34.63871	3.28	3
19 / .35	574 / 522.5	35.70404	3.47	3 3 3 3 3 3 3
20 / .27	575 / 522.5	31.38653	2,67	3

TOTAL METER VOLUME = 47.32401

AVG. STACK TEMP (R) = 572.9

AVG. STACK VEL (FT/SEC) = 32.26751

AVG. STACK VEL (FT/MIN) = 1936.051

AVG. METER TEMP (R) = 517

AVG. METER DELTA H (IN.H20) = 2.831

AVG. METER PRESSURE (IN.HG) = 29.22816

TOTAL MINS OF TEST = 60

STACK ACFM = 38014.24

STACK DSCFM = 31431.38

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#### ISOKINETIC ANALYSIS

PRINTER! BESTERS COSSESSE INSCESSE SESSESSES CONTRACTOR

TOTAL CONDENSATE VOLUME (ML) = 80.8

AVERAGE STACK TEMPERATURE (R) = 572.9

TOTAL METER GAS VOL (uncorrected CF) = 47.32401

AVG METER TEMP (R) = 517

BAROMETRIC PRESSURE (IN.HG) = 29.02

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 2.831

AVG. STACK VEL (FT/MIN) = 32.26751

STACK PRESSURE (IN.HG) = 29.0288

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 5.343376E-04

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 98.92119 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = 1.1479
SAMPLE WT. (GMS) = 1.1479
SAMPLE VOL. (DSCFM) = 47.21335
CONCENTRATION (GR/DSCF) = .3751502
% CO2 = 3.37
CONCENTRATION @ 12% CO2 (GR/DSCF) = 1.335847
STACK DSCFM = 31431.38
PM EMISSIONS (stk conds) (LB/HR) = 101.0649
PM EMISSIONS (@ 12% CO2) (LB/HR) = 359.8749

****** END OF ANALYSIS FOR RUN # 1 ******

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**** R U N # 2 ****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 285.3722

AMBIENT WET BULB (K) = 281.4833

SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 40.28562 DEG. F.
VAPOR PRESSURE (IN.HG) = .2496591
SATURATION VAPOR PRESS. (IN.HG) = .4175718
RELATIVE HUMIDITY (%) = 59.78831
SPECIFIC HUMIDITY (pp1000) = 5.365673

# METER DATA PROGRAM

# OF TEST POINTS = 20 AMBIENT PRESS. (IN.HG) = 29.02

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	59	59	59	2.18
	61	59	60	2.44
3	64	59	61.5	2.8
4	66	60	63	2.99
5	66	60	63	3.28
6	<b>6</b> 8	60	64	2.99
2 3 4 5 6 7	68	61	64.5	3.08
8	69	61	65	3.03
9	69	61	65	3.06
10	70	62	66	2.47
11	69	63	66	2.26
12	<b>6</b> 8	<b>6</b> 3	65.5	2.36
13	69	64	66.5	2.45
14	71	64	67.5	2.62
15	72	65	68.5	2.97
16	73	65	69	3.04
17	74	66	70	3.14
18	75	66	70.5	3.05
19	76	67	71.5	3.09
20	76	68	72	2.85

FINAL AVG. METER TEMP (R) = 525.9
DELTA H@ VALUE = 2.11
FINAL AVG. METER PRESS. (IN.HG) = 29.22644

*****************

#### H20 TEST DATA

START METER READING = 428.304
END METER READING = 475.886
TOTAL CONDENSATE VOL (ML) = 81.63
H20 VAPOR GAS VOLUME @ STP = 3.869262
TOTAL METER GAS VOL (uncorrected CF) = 47.582
AVG. METER TEMP (R) = 525.9
TOTAL DRY SAMPLE VOL (CF @ STP) = 46.66461
MOLE FRACTION DRY AIR = .9234323
% H20 BY VOL = 7.656769

#### GAS DENSITY

% CO2 = 3.03 % O2 = 17.3 % CO = 0 % N2 = 78

GAS DENSITY = .9633582

DRY MOL. WT. = 28.7092

# *******************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .313 NOZZLE AREA (FT2) = 5.343376E-04 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 29.02 STACK PRESS (IN.HG) = 29.0288 TEST START TIME = 1000

PT/DELTA P # / IN.H20		VELOCITY FT/SEC		TIME MINS
1 / .22	570 / 519	28.21619	2.18	3
2 / .245	570 / 520	29.77626	2.44	3
3 / .28	569 / 521.5	31.80422	2.8	3
4 / .3	572 / 523	33.00717	2.99	3
5 / .33	573 / 523	34.64846	3.28	3
6 / .3	573 / 524	33.03601	2.99	3
7 / .31	575 / 524.5	33.64065	3.08	3
8 / .305	576 / 525	33.39726	3.03	3
9 / .31	579 / 525	33.75746	3.06	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
10 / .25	581 / 526	30.36741	2.47	3
11 / .225	570 / 526	28.53503	2.26	3
12 / .235	570 / 525.5	29.16225	2.36	3
13 / .245	573 / 526.5	29.85451	2.45	3
14 / .26	570 / 527.5	30.67424	2.62	3
15 / .295	572 / 528.5	32.73095	2.97	3
16 / .3	569 / 529	32.9205	3.04	3
17 / .31	570 / 530	33.49407	3.14	3
18 / .3	569 / 530.5	32.9205	3.05	3
19 / .305	571 / 531.5	33.25198		3
20 / .28	570 / 532	31.83216	2.85	3

TOTAL METER VOLUME = 47.582

AVG. STACK TEMP (R) = 572.1

AVG. STACK VEL (FT/SEC) = 31.85136

AVG. STACK VEL (FT/MIN) = 1911.082

AVG. METER TEMP (R) = 525.9

AVG. METER DELTA H (IN.H20) = 2.8075

AVG. METER PRESSURE (IN.HG) = 29.22644

TOTAL MINS OF TEST = 60

STACK ACFM = 37523.97

STACK DSCFM = 31017.85

*********************

#### ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 81.63

AVERAGE STACK TEMPERATURE (R) = 572.1

TOTAL METER GAS VOL (uncorrected CF) = 47.582

AVG METER TEMP (R) = 525.9

BAROMETRIC PRESSURE (IN.HG) = 29.02

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 2.8075

AVG. STACK VEL (FT/MIN) = 31.85136

STACK PRESSURE (IN.HG) = 29.0288

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 5.343376E-04

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 99.06254 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = .4026

FINAL FILTER WT. (GMS) = .8052

SAMPLE WT. (GMS) = .4026

SAMPLE VOL. (DSCFM) = 46.66461

CONCENTRATION (GR/DSCF) = .1331227

% CO2 = 3.03

CONCENTRATION @ 12% CO2 (GR/DSCF) = .5272185

STACK DSCFM = 31017.85

PM EMISSIONS (stk conds) (LB/HR) = 35.39119

PM EMISSIONS (@ 12% CO2) (LB/HR) = 140.1631

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**** RUN #3 ****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 285.9278

AMBIENT WET BULB (K) = 282.5945

SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 43.74922 DEG. F.
VAPOR PRESSURE (IN.HG) = .2850438
SATURATION VAPOR PRESS. (IN.HG) = .4330654
RELATIVE HUMIDITY (%) = 65.82003
SPECIFIC HUMIDITY (pp1000) = 6.128993

# METER DATA PROGRAM

# OF TEST POINTS = 20 AMBIENT PRESS. (IN.HG) = 29.02

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	68	69	68.5	2.22
2	72	69	70.5	2.41
3	72	69	70.5	2.8
4	73	69	71	3.1
5	74	70	72	3.37
6	75	69	72	3.15
7	77	70	73.5	3.05
8	77	71	74	3.09
2 3 4 5 6 7 8 9	78	71	74.5	3.08
10	78	71	74.5	2.53
11	76	71	73.5	2.53
12	75	71	73	2.53
13	76	71	73.5	2.54
14	76	70	73	2.79
15	76	70	73	2.99
16	75	70	72.5	3.24
17	76	70	73	3.57
18	76	70	73	3.39
19	76	70	73	3.42
20	76	70	73	3.35

FINAL AVG. METER TEMP (R) = 532.575 DELTA H@ VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 29.23746 *************************

# H2O TEST DATA

START METER READING = 476.041
END METER READING = 524.95
TOTAL CONDENSATE VOL (ML) = 82.26
H20 VAPOR GAS VOLUME @ STP = 3.899124
TOTAL METER GAS VOL (uncorrected CF) = 48.90903
AVG. METER TEMP (R) = 532.575
TOTAL DRY SAMPLE VOL (CF @ STP) = 47.38275
MOLE FRACTION DRY AIR = .9239668
% H20 BY VOL = 7.603319

#### GAS DENSITY

% CO2 = 3.1 % O2 = 17

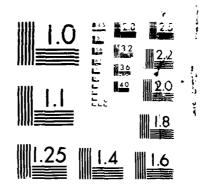
% CO = 0

% N2 = 78

GAS DENSITY = .961475

DRY MOL. WT. = 28.644

ND-R195 220 COMPLIANCE TESTING OF GRISSON AFB CENTRAL HEATING PLANT COAL-FIRED BOILER. (U) AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LAB BROOKS AF. J A GARRISON MAR 88 USAFDEHL-88-858608025CEF F/G 13/1 UNCLASSIFIED



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MICROCI PY RESOLUTION TEST CHIN NATIONAL BUREAU (II MANUARDS 1963

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# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .313 NOZZLE AREA (FT2) = 5.343376E-04 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 29.02 STACK PRESS (IN.HG) = 29.028

TEST START TIME = 1136

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H2O	TIME MINS
1 / .22	570 / 528.5	28.24381	2.22	3
2 / .24	575 / 530.5		2.41	3
3 / .28	578 / 530.5	32.08614	2.8	3
4 / .31	578 / 531	33.76131	3.1	3
5 / .335	576 / 532	35.03549	3.37	3
6 / .315	580 / 532	34.09132	3.15	3
7 / .305	581 / 533.5	33.57473	3.05	3
8 / .31	584 / 534	33.93609	3.09	3
9 / .31	587 / 534.5	34.02315	3.08	3
10 / .255	588 / 534.5	30.88398	2.53	3
11 / .25	575 / 533.5	30.23977	2.53	3
12 / .25	575 / 533	30.23977	2.53	3
13 / .255	583 / 533.5		2.54	3
14 / .28	584 / 533	32.25225	2.79	3
15 / .3	583 / 533	33.35565	2 <b>.9</b> 9	3
16 / .325	583 / 532.5	34.71766	3.24	3
17 / .355	577 / 533	36.09746	3.57	3
18 / .34	583 / 533	35.50981	3.39	3
19 / .345	586 / 533	35.86187		3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
20 / .34	589 / 533	35.69206	3.35	3

TOTAL METER VOLUME = 48.90903

AVG. STACK TEMP (R) = 580.75

AVG. STACK VEL (FT/SEC) = 32.99918

AVG. STACK VEL (FT/MIN) = 1979.951

AVG. METER TEMP (R) = 532.575

AVG. METER DELTA H (IN.H20) = 2.9575

AVG. METER PRESSURE (IN.HG) = 29.23746

TOTAL MINS OF TEST = 60

STACK DSCFM = 38876.22

STACK DSCFM = 31675.31

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#### ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 82.26

AVERAGE STACK TEMPERATURE (R) = 580.75

TOTAL METER GAS VOL (uncorrected CF) = 48.90903

AVG METER TEMP (R) = 532.575

BAROMETRIC PRESSURE (IN.HG) = 29.02

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 2.9575

AVG. STACK VEL (FT/MIN) = 32.99918

STACK PRESSURE (IN.HG) = 29.0288

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 5.343376E-04

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 98.50356 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0

FINAL FILTER WT. (GMS) = .3033

SAMPLE WT. (GMS) = .3033

SAMPLE VOL. (DSCFM) = 47.38275

CONCENTRATION (GR/DSCF) = 9.876841E-02

% CO2 = 3.1

CONCENTRATION @ 12% CO2 (GR/DSCF) = .3823294

STACK DSCFM = 31675.31

PM EMISSIONS (stk conds) (LB/HR) = 26.81455

PM EMISSIONS (@ 12% CO2) (LB/HR) = 103.7982

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<u>ರ</u>	3						)	V			されて	SAS FRACTION (Fd)	<del>-</del>	
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_1"	2			SCHEMATIC OF STACK CROSS SECTION	CK CROSS'S	ECTION	EQUATIONS				AMBIENT	TEMP		
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1-	CC						Start 4	16,041			DRY CAS	DHY GAS FRACTION (Fd)	(p.	
ـــ	THAVENOE	SAMPLING	STATIC	STACK TEMP	TEMP	VELOCITY	ORIFICE	GAS	6.45	GASMETER TE	EMP	SAMPLE	IMPINGER	
	PO.NT NUMBER	TIME (min)	PRESSURE	(oF)	(Ts) (9R)	HEAD (Vp)	PRESS.	SAMPLE VOLUME	N. (3E)	Avc (Tin)	00.0	BOX TEMP (OF)	OUTLET TEMP (OF)	
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9	*	3	6.5	8//		82	2.80		727	70.5	6/3	757	62	
 6	31	7	000	6//		1.01	2.10			1,1	19	457	77	T
	00	15/	200	120		3/6	2,3		13/5	1 - 1.	63	237	53	T
	Ċ	18	انما	17/		. 305	3,05		77	75.5	75	237	6.3	
	2	12	2.5	124		,3/	309		22	7%	14-	752	6	
		24	200	120		. 3/	302		1100	1/202	1/2	237	77	T
12.0		1209 30	3			120	2.53	500.188	76	73.5	1/2	242	17	T
	7	-3	2			527	2.53		75	,33	7.7	234	72	
	3	.,0	70	123		1255	2.54		7%	73.5	77	237	100	T
<del>-                                    </del>	1	12/	1 a	123		36	2.99		1/2	150	107	27.9	77	Τ
لــنا		15	10	123			3.29		75	72.5	70	235	7.7	
	7	8/	71.5	1117		,355,	- 4		76	(۲)	70	238	29	
	400	21	1.5	123		,34	3.39		15.	73	30	227	67	Ī
	,	77	11.5	M		1345	3.42		76	5	20	236	62	
	10	27	4.5	129		.34	3.35		76.	~	70	234	63	7
		<del>↑</del> 30 ★		1				524.150		m) 74	-			
٠						-	2,9575	48.1090		2017	+			
]	DEHL FORM	18 18												1

CONTRACTOR CONTRACTOR DESCRIPTION OF THE PARTIES OF

	AIR POLL	UTIO	N PARTICULA	ATE ANA	LYTICAL	DATA			
BASE BBR/S		ATE			·	# //	<u> </u>		
BUILDING NUMBER			\$	OURCE NU	MBER				
1.			PARTICUL	ATEC					
1.		_				** WEIGHT	7	FIGUR DADAGE	
13	EM	_	FINAL WE	IGHT	16 : 1	AL WEIGHT (@m)		EIGHT PARTICLES (gr)	
FILTER NUMBER			0, 29	97	0,0	2756		0.0241	
ACETONE WASHINGS Hall Filter)	(Probe, Front		103,55	539	102,	4301	3	. 1.1238	
BACK HALF (II needed	d)								
			Total Wel	ght of Partic	ulates Colle	cted	1.	1479 or	
II.			WATE	R					
17	TEM		FINAL WE	iG HT	1N 71	AL WEIGHT		WEIGHT WATER (gm)	
IMPINGER 1 (H20)			147		16	<i>70</i>		47	
IMPINGER 2 (H20)			15		10	<u> </u>		18	
IMPINGER 3 (Dry)			2.8		0			2.8	
IMPINGER 4 (SIIIca Gel)			214.05		201.05		13.0		
and the second	200 - 1		Total Weight of Water Collected				60,8 em		
111.	Τ	1	GASES	(Dry)		<del></del> _			
ITEM	ANALYSIS 1		ANALYSIS 2	ANA	3	ANALY5.8		AVE≑AGE	
vol % co₂	2.2	9	, <del>,</del>					3,37	
VOL * 02	16.5		6. 5	E				16.83	
VOL + CO									
VOL - NZ									
		Vol 9	7 N ₂ = (1005 - %)	co ₂ . % o ₂ .	• % CO:		**		

	AIR POL	LUTIC	ON PARTICUL	ATE ANA	LYTICAL	DATA			
BASE		DATE		<del></del>		RUN NUMBER			
R3 N2 St	maklier !					#10	2_		
BUILDING NUMBER				SOURCE NU	MBER				
1.			PARTICU		T				
١	TEM		FINAL WE		INIT	AL WEIGHT (am)	<b>"</b>	EIGHT PARTICLES (#m)	
FILTER NUMBER			0.30	つマス	0,	2775	1	0.0258	
		<del></del> -	1					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
ACETONE WASHINGS Half Filter)	(Probe, Front			110-	1.0 -			27.0	
			105.7	473	105	.3725	C	,3768	
BAER HALF (H =	-d)								
BACK HALF (If needs	, , , , , , , , , , , , , , , , , , ,								
			Total We	ight of Partic	culates Colle	ected	1	4026 .	
11.			WATE	ER					
, <u> </u>			FINAL WE		INITI	AL WEIGHT		WEIGHT WATER	
1	TEM		( <b>e</b> m)			( <b>g</b> m)		( <b>g</b> m)	
IMPINGER 1 (H20)			133		10	D .		33	
<del></del>				<del></del>		<del></del>			
IMPINGER 2 (H20)			125		100	)	l	25	
			123	·					
(MPINGER 3 (Dry.)							ا رر سر		
IMP INGEN 3 (DIS)			5.4		U			5.4	
			0.042.50		30	20177		1000	
IMPINGER 4 (Silica Gel)			220.00 201.77			6/1/	18,23		
							<u> </u>		
			Total Weight of Water Collected					81.63 -	
III.			GASES	(Dry)			L	0 0 0	
	ANALYSIS	Ţ	ANALYSIS		LYSIS	ANALYSIS		AVERAGE	
ITEM	1		2		3	4		AVERAGE	
VOL + CO2	20		3	2	2				
\$02 ; CO ₂	2.9		$\supset$	3.	~			<i>3.</i> 03	
	100		· =	1					
VOL + 02	17.3		17.2	17.	7			17,3	
		+	· ·	<del>                                     </del>				1 / 🗡	
VOL * CO									
		<del> </del>		ļ					
VOL + N2							1		
¥0L 142									
	<u></u>								
		Vol 5	% N2 = (100% - %	CO2.%O2.	% CO)				

	AIR POLL	UTIO	N PARTICUL	ATE ANA	LYTICAL	DATA		
DASE	C	ATE		<del>,</del>		RUN NUMBER		π.
SERE!	Scrubber					<u> K</u>	7	#13
BUILDING NUMBER				SOURCE NU	MBER			
l			PARTICU	LATES				
	TEM		FINAL WE (gm)	IGHT	INIT	AL WEIGHT (#m)	w	EIGHT PARTICLES
FILTER NUMBER			0.30	86	00	1778	0	0.0308
ACETONE WASHINGS Hall Filter)	(Probe, Front		100,6	792	100.	.4067	0	,2725
BACK HALF (if neede	od)							
			Total Wei	ght of Partic	ulates Colle	eted		3033 em
11.			WATE	R	_		·	
ı	TEM		FINAL WE	IGHT	INIT	AL WEIGHT		WEIGHT WATER (@m)
IMPINSER 1 (H20)			153	_	100	2		53
IMPINGER 2 (H20)			112	:	100			12
IMPINGER 3 (Dry)			2.2 0				2.2	
IMPINGER 4 (SIII CO 001) 237, 8 21, 3			2,2 0		1,44	15.06		
			Total Weight of Water Collected				82.26	
101.	7	7	GASES	(Dry)		,		
ITEM	ANALYSIS 1		ANALYSIS 2	ANAI	_YSIS 	A NA L YSIS		AVERAGE
۷٥L % CO ₂	3-1	-	5, 8.	3.	0			3.
۷0L % 0 ₂	16.8	/	7,0	17.	/			Ho. 17.0
VOL % CO								
VOL T N2								
		Vol %	N ₂ = (100% - % (	CO ₂ . % O ₂ .	% CO)			

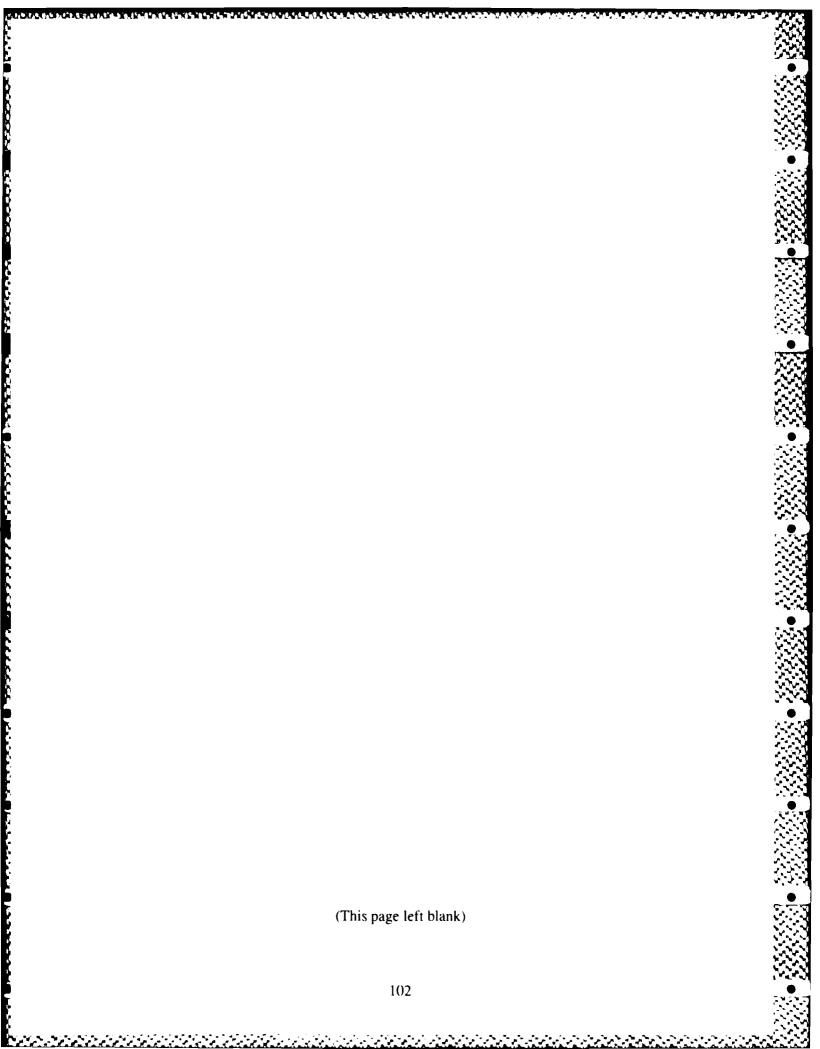
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APPENDIX G

Boiler 4, Bypass Stack



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SOURCE TEST REPORT

SOURCE :

GRISSOM AFB CENTRAL HEATING PLANT

GRISSOM AFB, IN 46971

DEVICE TESTED : BOILER #4:BYPASS STACK

DATE TESTED: 21 NOV 87

SUBMITTING AGENCY:

USAFOEHL/ECQ

BROOKS AFB, TX 78235

# DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: BYPHSS Stack diameter at ports: 5.5 (ft)

Distance A (ft) 11.5 (duct diameters) 2.1

Recommended number of traverse points as determined by

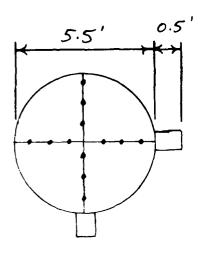
distance A: 12

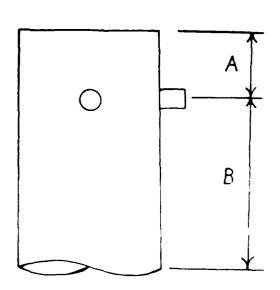
Distance B (ft) 39.5 (duct diameters) 7.2

Recommended number of traverse points as determined by

distance B: 12

Number of traverse points used: 12





***********************

# TEST TRAVERSE POINT LOCATION

STACK DIAM. (IN.) = 66 STACK RADIUS (IN.) = 33 STACK DIAM. (FT.) = 5.5 STACK AREA (SQ.FT) = 23.75828

POINT #	DISTANCE IN.
1	2.875261
2	9.665478
3	19.52781
4	46.4722
5	56.33452
6	63.12474

THE ABOVE DISTANCES PROCEED FROM THE TEST PORT ACROSS THE TRAVERSE TO THE OPPOSITE WALL OF THE STACK.

THESE DISTANCES SHOULD BE ROUNDED OFF TO THE NEAREST 1/4 INCH.

THAT'S ABOUT AS ACCURATE AS YOU CAN GET WITH AN EPA METHOD 5 PROBE.

#### STANDARD CONDITIONS (TEMP. AND PRESSURE)

STD.TEMP (F) = 68 STD.TEMP (R) = 528 STD. PRESSURE (IN.HG) = 29.92 **********

**** R II N # 1 ****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 269.2611
AMBIENT WET BULB (K) = 268.15
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 18.65837 DEG. F. VAPOR PRESSURE (IN.HG) = .1044835 SATURATION VAPOR PRESS. (IN.HG) = .1359793 RELATIVE HUMIDITY (%) = 76.83784 SPECIFIC HUMIDITY (pp1000) = 2.24131

# METER DATA PROGRAM

# OF TEST POINTS = 12 AMBIENT PRESS. (IN.HG) = 30.33

POINT #	TEMP IN	TEMP OUT	AVG TEMP	Delta H IN.H2O
"	•	•	·	2
1	44	42	43	.79
2	48	43	45.5	1.58
3	52	45	48.5	1.59
4	55	46	50.5	1.59
5	57	47	52	1.195
6	57	49	53	1.4
7	50	48	49	.79
8	51	49	50	1.59
9	53	49	51	1.99
10	54	50	52	1.79
11	53	49	51	1.59
12	53	49	51	1.6

FINAL AVG. METER TEMP (R) = 509.7084 DELTA H@ VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 30.4372

# **H2O TEST DATA**

START METER READING = 147.777
END METER READING = 180.796
TOTAL CONDENSATE VOL (ML) = 58.42
H20 VAPOR GAS VOLUME @ STP = 2.769108
TOTAL METER GAS VOL (uncorrected CF) = 33.01901
AVG. METER TEMP (R) = 509.7084
TOTAL DRY SAMPLE VOL (CF @ STP) = 34.79521
MOLE FRACTION DRY AIR = .9262836
% H20 BY VOL = 7.371646

# GAS DENSITY

% CO2 = 9.13 % O2 = 9.2 % CO = 0 % N2 = 78

GAS DENSITY = .9673566

DRY MOL. WT. = 28.8012

**************

#### SOURCE TEST DATA

NOZZLE DIAM (IN.) = .498 NOZZLE AREA (FT2) = 1.352651E-03 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 30.33 STACK PRESS (IN.HG) = 30.3381 TEST START TIME = 924

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PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H20	TIME MINS
1 / .02	880 / 503	10.31874	.79	5
2 / .04	880 / 505.5	14.59291	1.58	5
3 / .04	881 / 508.5	14.6012	1.59	5
4 / .04	883 / 510.5	14.61776	1.59	5
5 / .03	871 / 512	12.57304	1.195	5
6 / .035	875 / 513	13.61158	1.4	5
7 / .02	880 / 509	10.31874	.79	5
8 / .04	880 / 510	14.59291	1.59	5
9 / .05	882 / 511	16.3339	1.99	5
10 / .045	884 / 512	15.51326	1.79	5
11 / .04	881 / 511	14.6012	1.59	5
12 / .04	875 / 511	14.55139	1.6	5

TOTAL METER VOLUME = 33.01901 AVG. STACK TEMP (R) = 879.3333 AVG. STACK VEL (FT/SEC) = 13.85222 AVG. STACK VEL (FT/MIN) = 831.1331 AVG. METER TEMP (R) = 509.7084 AVG. METER DELTA H (IN.H20) = 1.457917 AVG. METER PRESSURE (IN.HG) = 30.4372 TOTAL MINS OF TEST = 60 STACK ACFM = 19746.29 STACK DSCFM = 11133.22 **********************

#### ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 58.42

AVERAGE STACK TEMPERATURE (R) = 879.3333

TOTAL METER GAS VOL (uncorrected CF) = 33.01901

AVG METER TEMP (R) = 509.7084

BAROMETRIC PRESSURE (IN.HG) = 30.33

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 1.457917

AVG. STACK VEL (FT/MIN) = 13.85222

STACK PRESSURE (IN.HG) = 30.3381

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 1.352651E-03

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 98.39307 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = .4139
SAMPLE WT. (GMS) = .4139
SAMPLE VOL. (DSCFM) = 34.79521
CONCENTRATION (GR/DSCF) = .1835448
% CO2 = 9.13
CONCENTRATION @ 12% CO2 (GR/DSCF) = .2412418
STACK DSCFM = 11133.22
PM EMISSIONS (stk conds) (LB/HR) = 17.51436
PM EMISSIONS (@ 12% CO2) (LB/HR) = 23.01996

****** END OF ANALYSIS FOR RUN # 1 ******

*****

***** RUN # 2 *****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K.

AMBIENT DRY BULB (K) = 273.7055

AMBIENT WET BULB (K) = 270.9278

SCURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 18.03984 DEG. F.
VAPOR PRESSURE (IN.HG) = .1017945
SATURATION VAPOR PRESS. (IN.HG) = .1877665
RELATIVE HUMIDITY (%) = 54.21335
SPECIFIC HUMIDITY (pp1000) = 2.18355

#### METER DATA PROGRAM

# OF TEST POINTS = 12 AMBIENT PRESS. (IN.HG) = 30.33

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	51	50	50.5	1.2
2	53	50	51.5	1.6
3	55	50	52.5	2.2
4	57	51	54	2.41
5	59	52	55.5	1.81
6	60	52	56	1.41
7	55	53	54	1.2
8	60	55	57.5	1.62
9	64	57	60.5	1.62
10	66	58	62	1.63
11	66	59	62.5	1.65
12	67	60	63.5	1.46

FINAL AVG. METER TEMP (R) = 516.6667

DE_TA H@ VALUE = 2.11

FINAL AVG. METER PRESS. (IN.HG) = 30.45138

************************

#### H2O TEST DATA

START METER READING = 181.07
END METER READING = 216.608
TOTAL CONDENSATE VOL (ML) = 65.54
H20 VAPOR GAS VOLUME @ STP = 3.106596
TOTAL METER GAS VOL (uncorrected CF) = 35.538
AVG. METER TEMP (R) = 516.6667
TOTAL DRY SAMPLE VOL (CF @ STP) = 36.96254
MOLE FRACTION DRY AIR = .9224691
% H20 BY VOL = 7.753089

# GAS DENSITY

% CO2 = 9.33 % O2 = 10.1 % CO = 0

end opposed opposed and the second opposed and seconds and second opposed and second opposed opposed opposed

% N2 = 78

GAS DENSITY = .9779143

DRY MOL. WT. = 29.1772

# *******************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .498 NOZZLE AREA (FT2) = 1.352651E-03 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 30.33 STACK PRESS (IN.HG) = 30.3381 TEST START TIME = 1201

SECTION DESCRIPTION OF THE SECTION O

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H	TIME
# / IN.HZU	ĸ	FI/SEC	IN.H20	MINS
1 / .03	880 / 510.5	12.56943	1.2	5
2 / .04	880 / 511.5	14.51392	1.6	5
3 / .055	868 / 512.5	16.90264	2.2	5
4 / .06	865 / 514	17.6237	2.41	5
5 / .045	879 / 515.5	15.38559	1.81	5
6 / .035	881 / 516	13.58424	1.41	5
7 / .03	880 / 514	12.56943	1.2	5
8 / .04	880 / 517.5	14.51392	1.62	5
9 / .04	862 / 520.5	14.36472	1.62	5
10 / .04	870 / 522	14.43122	1.63	5
11 / .04	868 / 522.5	14.41462	1.65	5
12 / .035	863 / 523.5	13.44476	1 46	5

TOTAL METER VOLUME = 35.538

AVG. STACK TEMP (R) = 873

AVG. STACK VEL (FT/SEC) = 14.52652

AVG. STACK VEL (FT/MIN) = 871.5909

AVG. METER TEMP (R) = 516.6667

AVG. METER DELTA H (IN.H20) = 1.650833

AVG. METER PRESSURE (IN.HG) = 30.45138

TOTAL MINS OF TEST = 60

STACK ACFM = 20707.5

STACK DSCFM = 11711.43

*********************

# ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 65.54

AVERAGE STACK TEMPERATURE (R) = 873

TOTAL METER GAS VOL (uncorrected CF) = 35.538

AVG METER TEMP (R) = 516.6667

BAROMETRIC PRESSURE (IN.HG) = 30.33

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 1.650833

AVG. STACK VEL (FT/MIN) = 14.52652

STACK PRESSURE (IN.HG) = 30.3381

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 1.352651E-03

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 99.33039 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = .5538

SAMPLE WT. (GMS) = .5538

SAMPLE VOL. (DSCFM) = 36.96254

CONCENTRATION (GR/DSCF) = .2311836
% CO2 = 9.33

CONCENTRATION @ 12% CO2 (GR/DSCF) = .2973423

STACK DSCFM = 11711.43

PM EMISSIONS (stk conds) (LB/HR) = 23.2059

PM EMISSIONS (@ 12% CO2) (LB/HR) = 29.84682

****** END OF ANALYSIS FOR RUN # 2 ******

*************

**** RUN # 3 ****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 274.2611
AMBIENT WET BULB (K) = 271.4833
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 19.4752 DEG. F.
VAPOR PRESSURE (IN.HG) = .1081325
SATURATION VAPOR PRESS. (IN.HG) = .1953517
RELATIVE HUMIDITY (%) = 55.35275
SPECIFIC HUMIDITY (pp1000) = 2.319696

#### METER DATA PROGRAM

# OF TEST POINTS = 12 AMBIENT PRESS. (IN.HG) = 30.33

POINT	TEMP IN	TEMP OUT	AVG TEMP	Delta H
#	F	F	F	IN.H20
1	62	62	62	1.02
2	63	62	62.5	1.63
3	67	63	65	1.84
4	69	64	66.5	1.64
5	70	64	67	1.64
6	71	65	68	1.44
7	68	66	67	.82
8	68	66	67	1.44
9	67	66	66.5	2.05
10	68	66	67	1.85
11	68	65	66.5	1.64
12	68	65	66.5	1.23

FINAL AVG. METER TEMP (R) = 525.9583 DELTA H0 VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 30.44177

#### H2O TEST DATA

START METER READING = 216.808
END METER READING = 251.399
TOTAL CONDENSATE VOL (ML) = 60.36
H20 VAPOR GAS VOLUME @ STP = 2.861064
TOTAL METER GAS VOL (uncorrected CF) = 34.591
AVG. METER TEMP (R) = 525.9583
TOTAL DRY SAMPLE VOL (CF @ STP) = 35.33084
MOLE FRACTION DRY AIR = .9250871
% H20 BY VOL = 7.491285

# GAS DENSITY

% CO2 = 9.53 % O2 = 9.43 % CO = 0 % N2 = 78

GAS DENSITY = .9748861

DRY MOL. WT. = 29.0508

*******************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .498 NOZZLE AREA (FT2) = 1.352651E-03 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 30.33 STACK PRESS (IN.HG) = 30.3381 TEST START TIME = 1415

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H2O	TIME MINS
7 / INTIEC	r.	11/320	14.1120	HINS
1 / .025	880 / 522	11.49207	1.02	5
2 / .04	880 / 522.5	14.53645	1.63	5
3 / .045	887 / 525	15.47943	1.84	5
4 / .04	887 / 526.5	14.59415	1.64	5
5 / .04	886 / 527	14.58592	1.64	5
6 / .035	877 / 528	13.5744	1.44	5
7 / .02	880 / 527	10.27882	.82	5
8 / .035	880 / 527	13.5976	1.44	5
9 / .05	882 / 526.5	16.2707	2.05	5
10 / .045	888 / 527	15.48816	1.85	5
11 / .04	878 / 526.5	14.51992	1.64	5
12 / .03	866 / 526.5	12.48839	1.23	5

TOTAL METER VOLUME = 34.591

AVG. STACK TEMP (R) = 880.9167

AVG. STACK VEL (FT/SEC) = 13.90883

AVG. STACK VEL (FT/MIN) = 834.53

AVG. METER TEMP (R) = 525.9583

AVG. METER DELTA H (IN.H20) = 1.52

AVG. METER PRESSURE (IN.HG) = 30.44177

TOTAL MINS OF TEST = 60

STACK ACFM = 19826.99

STACK DSCFM = 11144.21

**********************

#### ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 60.36

AVERAGE STACK TEMPERATURE (R) = 880.9167

TOTAL METER GAS VOL (uncorrected CF) = 34.591

AVG METER TEMP (R) = 525.9583

BAROMETRIC PRESSURE (IN.HG) = 30.33

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 1.52

AVG. STACK VEL (FT/MIN) = 13.90883

STACK PRESSURE (IN.HG) = 30.3381

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 1.352651E-03

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 99.7994 %

# PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = .3345
SAMPLE WT. (GMS) = .3345
SAMPLE VOL. (DSCFM) = 35.33084
CONCENTRATION (GR/DSCF) = .1460859
% CO2 = 9.53
CONCENTRATION @ 12% CO2 (GR/DSCF) = .1839486
STACK DSCFM = 11144.21
PM EMISSIONS (stk conds) (LB/HR) = 13.95369
PM EMISSIONS (@ 12% CO2) (LB/HR) = 17.57023

***** END OF ANALYSIS FOR RUN # 3 ******

	SS III III III III III III III III III	11 hs	(P	WIMPINGER OUTLET TEMP	45	54	45	4	59	310	5.5	25					
	PRE LUI	HE ATE	GAS FRACTION (Fd)	SAMPLE BOX TEMP	270	6.5%	26.7	1.6 8	259	26	257	253					
	STATION OF THE ALL	PHOBE PHOBE	- Ha	METER TEMPO AVG OUT (Tm)	13 47	7	25 16	53 44	3/ 63		24	144		TIT	46.11		
			,	G GAS ME	+		5.7	17,	35	53	+	1		Q	Ī		-
SHEET	+ 460 5130-F-G-Cp-A 2	3 17 w.j	7.707	GAS SAMPLE VOLUME	142,227		1,195	163.783				Part Decorat	180.769	32.9920			
SAMPLING DATA	OR = OF + 460  H = \[ \frac{5130.6}{5130.6}	The state of the s	#/ +J#S	ORIFICE DIFF. PRESS.	0:73	477	0.801.59	oh"	0.79	66.	5.7	1.60		9 1. 1.	1.		
TE	ECTION	is the said		VELOCITY HEAD (Vp)	0.09	6.04	00.00	,035	107	200	300	,04	£.631.	∃`⊢		420	
PART	SCHEMATIC OF STACK CROSS SECTION	check goin	+	(Ts)									2101	1	100	7)	7
	ENATIC OF ST	Reak Chr.	5 ming/	STACK OF,	3 426	124 5	XI 411	415	9 420	1	95 421	0 415		100	2007	000	10.0X
	Lucia Sen	7	7,	STATIC PHESSURE (C	00.11			F)				7		,	$\rightarrow$	7	4)
	1641.#	NOMBER Nymber		SAMPLING TIME (min)	0124 5	(a)	25	30	1:001	0/	70	35		M.	4/4/04		
	Stoads of the standard of the	HOX S	J	TRAVEHSE POINT NUMBER	.,7,	101	1, 2,	ं	7	17		2		*	77.77		

FUN N			TE	SAMPLING DATA SHEET	SHEET				
	SUN NUMBER KINT & BOYLEY	₹ ZCH	CROSS SECTION	EQUATIONS  OR = OF + 460			AM ,	AMBIENT TEMP	국 o
PLANT	21, Une ( sat)	Soct Ulassocial (interstrates)	1 -	Н = 5130.	5130-Fd-Cp-A 2 7	T. Vp	<u> </u>	30.33 HEATER BOX TEMP	in Hg
BASE				(A) puto	3.5		PR	PROBE HEATER SETTING	HO NG
SAMPL	ALL PASSER R BOX NUMBER A BOX NUMBER	(2) 12" Hg	in the training	ra (	Ž		A O	PROBE LENGTH  AMARY  NOZZLE AREA (A)	III bs
S 0	an an	J. Will J.	+		(31. 14.4)	020	DRY	S SAS FRACTION (F'd)	q)
TR A	-	STACK	TEMP VELOCITY	ORIFICE	GAS	-S	METER TEMP	SAMPLE	IMPINGER
ă o	POINT TIME NUMBER (BID)	PRESSURE (aF)	(Ts) HEAD (oR) (Vp)	OIFF. PRESS. (H)	<b>₹</b> 5 0	N (0 F)	AVG OUT (Tm) (OF)	BOX TEMP (oF)	OUTLET TEMP (OF)
		0.11 4 450	50'	-17	010.181		1	- 3 (	5.8
1		20% 6	200	7,62		3	(2)	+-	50%
19		13 40.5	0.00	3.71		r e.	7.5 7.5		100
``	3 -2	1, 1,	350	14.7		57	2,7	1 200	*
	30	7 62.7	0.05	7	199.336	2	<b>)</b> \ \ \ \ \	1110	6.17
		10 220	2000	1,62			27:12	1	
	37	207 07	000	1,6,2		*	10.5		37
	7	7 7 11	0.01	1.1.2			7- 8-5-	263	57
1		11.5 11.5	2500	1.40	601 1/6	6.7	10.5	372	
	20	<b>*</b>			777				
		2000							
		5/00		1,6525					
	.7,2	200			35.5380		56,67		

				PART	ICULATE SA	ARTICULATE SAMPLING DATA SHEET	, SHEET					
HUN NUMBER	40 %	SCHEM	SCHEMATIC OF STACK CROSS SECTION	EK CROSS'S	ECTION	EQUATIONS				AMBIENT	r YEMP	
7 - 3		-				$^{\circ}R = ^{\circ}F + 460$	0			STATION PRESS	PRESS	40
	(t) (ix					_	- 5130.Fd Cp. A 7 2	Î.		<u>;;</u> }	19	no the
LNAJA					_	       	· ,	Ts.		HEATER	HEATER BOX TEMP	
BASE			-	277	nak-					PROBE +	PROBE HEATER SETTING	NG OF
332	HIGHER	V		, "H" -)					•	PHOUSE LENGTH	ENGTH	
METER BOX N	BUX NUMBER	<u> </u>	- 	-						NOZZLE	A 12014 8	9
18.70	}									1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1	/70	1 50
C		12	1/1/			XX	1. 8. 3. Z.	1.50		CHY CAS	CHY LAS FRACTION (Fd)	Ð
THAVINGE	SAMPLING	TATIC	STACK TEMP	TEMP	VELOCITY	ORIFICE	GAS	,	]=	a g	SAMPLE	IMPINGER
POINT NOMBER	T 1ME (m.10.)	UN HOU)	_	G T. S. (3	HEAD (Vp)	PRESS.	SAMPLE VOLUME (cu ft)	3.E.	۲۲۲ کوروزی گوروزی	our (oF)	TEMP (9F)	OUTLE F TEMP (oF)
7	11/2/	3.11	13.5%			207	216.803	7	7		351	52
	5	11	3		0.0.4	163		6.5	7 5 7		756	.73
	76	6	3		<b>∵</b> I	4041	7.	1	7:0	-	25.5	25
4   10	,,,		400		1000	1777		750		*	- (2, 12)	471
				0.00		77 %		11			1	
	] '[						234.134	43	4			
,	1522,0		0.7		002	68.0		27	7 6 7	36	7.5%	X-1
	75	<b>* &gt; &gt;</b>	12.5		0.035	1,4%		\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;\;		1		77.
3	5/	11	1/1/2		0.0-15	1		2		- 2	2	17.5
	20)	7/	15/1/2		7.00	15.7%		100		57.	75, 3	5.5
		()/	1,7,7,7		(.03	バイラ	403136	0	1	-	7.0%	750
	77.			!						!		
							34,5910					
									al: 57			
						1.52				++		
OEML FORM	18											

	AIR POLLU	TION PARTICUL	ATE ANA	LYTICAL	DATA		
BASE Bygnes	DA				KUY #4	<u> </u>	
BUILDING NUMBER			SOURCE NU	MBER			
1.		PARTICU	LATES				
17	EM	FINAL WE		- E	AL WEIGHT	we	EIGHT PARTICLES
FILTER NUMBER	· · · · · · · · · · · · · · · · · · ·	0,63	94 -	(),	755	C	), 3646
ACETONE WASHINGS ( Hall Filter)	(Probe, Front	99,15	60	99,	1067	0	.0493
BACK HALF (if needed	d)		_				
*		Total We	ight of Partic	ulates Colle	cted	. 4	4/39 em
11.		WAT	R				
17	'EM	FINAL WE	IGHT	INITI	AL WEIGHT		WEIGHT WATER
IMPINGER 1 (H20)			126	100	) 		26
IMPINGER 2 (H20)		11	B	100		18	
IMPINGER 3 (Dry)		2	3		3		
IMPINGER 4 (Silica Ge	236. "Tare à:1.3"	7 215,	4	200	3.98	1	1.42
	215.4	Total We	ight of Water	Collected		58	7. 42 em
111.		GASES	(Dry)				
łTEM	ANALYSIS 1	ANALYSIS 2	ANA	L YSIS 3	ANALYSIS		AVERAGE
VOL % CO ₂	9.2	9,0	9,	2			9.13
VOL % 02	9.2	9.2.	9,0	J_			9.2
VOL - CO							
VOL - N2							
	v	ol % N ₂ = (100% - %	CO ₂ - % O ₂	• % CO)			

	AIR POLI	LUTIO	N PARTICUL	ATE ANA	LYTICAL	DATA			
BASE		DATE	<del></del>			RUN NUMBER			
64 RQ	GUIDAN		,		!	# 5			
BUILDING NUMBER	Marie 1			SOURCE NUI	MBER				
	U*								
1.			PARTICU	LATES	,				
	ITEM		FINAL WE (gm)	THDI	INITI	AL WEIGHT (gen)		PARTICLES #m/	
							<u>`</u>		
FILTER NUMBER	•		0,76	75	0.	2756	, 4	19/9	
ACETONE WASHING Half Filter)	S (Probe, Front		98.47	743	98	4124		1619	
PACK HALF (If need	ded)					·			
			Total Wei	ght of Partic	ulates Colle	cted	.55	38 am	
11.			WATE	P	<del></del>				
***			FINAL WE		[NIT]	AL WEIGHT	WEIGH	IT WATER	
	ITEM		( <b>∉</b> m)			( <b>e</b> m)		gm)	
IMPINGER 1 (H20)			125	2	/:9	0	25	5	
IMPINGER 2 (H20)			120		10	)	20		
IMPINGER 3 (Dry)	,		6		0		6		
IMPINGER 4 (SIIIca	GOI) [M2]	241	- 2:	221	207.56		14.54		
/ <del>***</del>			Total Weight of Wate		Collected		65.5	54 <b>s</b> m	
tii.			GASES	(Dry)					
ITEM	ANALYSIS 1		ANALYSIS 2		_ YSIS 3	ANALYSIS 4		VERAGE	
VOL % CO2	9.2	9	7,4	9,	4		9,	33	
VOL * 0 ₂	10,2	/	10, 2	9,0	9		10	, i	
VOL ₹ CO									
VOL - N2									
1		Vol %	N2 = (100% - % )	CO ₂ . % O ₂ .	% CO)				

	AIR POLLUT	ION PARTICUL	ATE ANA	LYTICAL	DATA			
PASE	BUILDING NUMBER DATE			EUN NUMBER				
BUILDING NUMBER			SOURCE NU	MRE 6				
ł.		PARTICU	LATES					
	TEM		FINAL WEIGHT (gm)		INITIAL WEIGHT (Am)		WEIGHT PARTICL	
FILTER NUMBER		0.57	0.5701		0.27,54		94	
ACETONE WASHINGS Hall Filter)	(Probe, Front	96,3	96,3136		96,2738		98	
BACK HALF (II need	ed)							
		Total We	Total Weight of Particulates Calli		ected	.334	5	
II.		WATER FINAL WEIGHT		INITI	AL WEIGHT	WEIGHT	WATE	
IMPINGER 1 (H20)			138		( <b>g</b> m)		) •	
IMPINGER 2 (H20)		110	110		100		38	
IMPINGER 3 (Dry)		/)		0		0		
IMPINGER 4 (SIIIco Gol) - 21.2		2 2/	21/24		204,04		 >	
			Total Weight of Water Collected		60.3			
III.	ANALYSIS	GASES ANALYSIS	T	.YSIS	ANALYSIS			
IT E M	1	2		3	4	AVE	RAGE	
VOL % CO ₂	9.6	9,6	7,2	<u> </u>		9.	53	
VOL % O ₂	9.6	9.4	9.3			9,1	13	
VOL % CO								
VOL % N2								

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APPENDIX H

Boiler 4, Scrubber Stack

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SOURCE TEST REPORT

SOURCE :

GRISSOM AFB CENTRAL HEATING PLANT

GRISSOM AFB, IN 46971

DEVICE TESTED : BOILER #4:SCRUBBER STACK

DATE TESTED: 22 NOV 87

SUBMITTING AGENCY: USAFOEHL/ECQ

BROOKS AFB, TX 78235

#### DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID:  $\frac{SCRUBRER}{STACKB}$  Stack diameter at ports:  $\frac{5.0}{STACKB}$  (ft)

Distance A (ft) 7.0 (duct diameters) /.4

Recommended number of traverse points as determined by

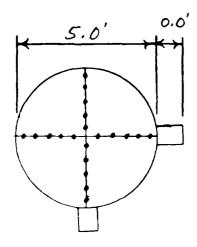
distance A: 20

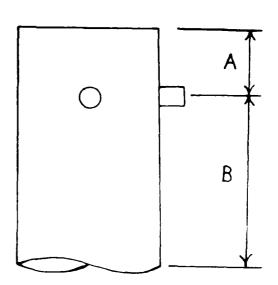
Distance B (ft) 28 (duct diameters) 5.6

Recommended number of traverse points as determined by

distance B: 20

Number of traverse points used: 20





***********************

# TEST TRAVERSE POINT LOCATION

```
STACK DIAM. (IN.) = 60

STACK RADIUS (IN.) = 30

STACK DIAM. (FT.) = 5

STACK AREA (SQ.FT) = 19.63494
```

CONTRACTOR CONTRACTOR CONTRACTOR ASSESSMENT OF THE CONTRACTOR OF T

POINT	#	DISTANCE IN.
1		1.539501
2		4.9002
3		8.786797
4		13,56832
5		20.51317
6		39.48683
7		46.43168
8		51.21321
9		<b>55.099</b> 8
10		58.4605

THE ABOVE DISTANCES PROCEED FROM THE TEST PORT ACROSS THE TRAVERSE TO THE OPPOSITE WALL OF THE STACK.
THESE DISTANCES SHOULD BE ROUNDED OFF TO THE NEAREST 1/4 INCH.
THAT'S ABOUT AS ACCURATE AS YOU CAN GET WITH AN EPA METHOD 5 PROBE.

# STANDARD CONDITIONS (TEMP. AND PRESSURE)

```
STD.TEMP (F) = 68
STD.TEMP (R) = 528
STD. PRESSURE (IN.HG) = 29.92
```

**************

#### ***** R U N # 1 *****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 280.9278
AMBIENT WET BULB (K) = 275.9278
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 23.2294 DEG. F.
VAPOR PRESSURE (IN.HG) = .1264235
SATURATION VAPOR PRESS. (IN.HG) = .3103822
RELATIVE HUMIDITY (%) = 40.73154
SPECIFIC HUMIDITY (pp1000) = 2.712726

# METER DATA PROGRAM

# OF TEST POINTS = 20 AMBIENT PRESS. (IN.HG) = 30.13

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	55	55	<b>5</b> 5	1.69
	59	55	<b>5</b> 7	2.04
3	61	56	58.5	2
4	63	56	59.5	2.22
5	64	57	60.5	2.36
6	66	58	62	2.49
2 3 4 5 6 7	68	59	63.5	2.49
8	69	60	64.5	2.52
8 9	70	60	65	2.53
10	71	62	66.5	1.94
11	69	62	65.5	1.37
12	69	63	66	1.82
13	69	63	66	2.16
14	70	63	66.5	2.25
15	70	63	66.5	2.66
16	70	63	66.5	2.57
17	70	63	66.5	2.57
18	70	63	66.5	2.59
19	69	63	66	2.8
20	69	63	66	2.2

FINAL AVG. METER TEMP (R) = 523.7 DELTA H@ VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 30.29643 ***********************

# H2O TEST DATA

START METER READING = 251.672
END METER READING = 293.905
TOTAL CONDENSATE VOL (ML) = 75.13
H20 VAPOR GAS VOLUME @ STP = 3.561162
TOTAL METER GAS VOL (uncorrected CF) = 42.233
AVG. METER TEMP (R) = 523.7
TOTAL DRY SAMPLE VOL (CF @ STP) = 43.11548
MOLE FRACTION DRY AIR = .9237057
% H20 BY VOL = 7.629431

# GAS DENSITY

% CO2 = 4.43 % O2 = 15.1 % CO = 0 % N2 = 78

GAS DENSITY = .9606515

DRY MOL. WT. = 28.6212

# *****************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .313 NOZZLE AREA (FT2) = 5.343376E-04 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 30.13 STACK PRESS (IN.HG) = 30.1418 TEST START TIME = 1115

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H2O	TIME MINS
# / IN.H20  1 / .17 2 / .205 3 / .205 4 / .225 5 / .24 6 / .255 7 / .255 8 / .255 9 / .255 10 / .195 11 / .135 12 / .18 13 / .22 14 / .23 15 / .27 16 / .26	R  566 / 515  575 / 517  580 / 518.5  575 / 519.5  576 / 520.5  582 / 522  585 / 523.5  579 / 524.5  577 / 525  577 / 526.5  566 / 525.5  566 / 526  583 / 526	FT/SEC  24.28976 26.88447 27.0011 28.16539 29.11437 30.16631 30.24395 30.08846 30.03644 26.26611 21.6454 24.99396 28.04376 28.77223 31.06753 30.43444	1.69 2.04 2 2.22	MINS 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
17 / .26 18 / .267 19 / .29 20 / .23	592 / 526.5 594 / 526 600 / 526	31.132 32.49996	2.59 2.8 2.2	3 3 3

```
TOTAL METER VOLUME = 42.233

AVG. STACK TEMP (R) = 580.5

AVG. STACK VEL (FT/SEC) = 28.52499

AVG. STACK VEL (FT/MIN) = 1711.499

AVG. METER TEMP (R) = 523.7

AVG. METER DELTA H (IN.H20) = 2.2635

AVG. METER PRESSURE (IN.HG) = 30.29643

TOTAL MINS OF TEST = 60

STACK ACFM = 33605.19

STACK DSCFM = 28432.12
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#### ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 75.13

AVERAGE STACK TEMPERATURE (R) = 580.5

TOTAL METER GAS VOL (uncorrected CF) = 42.233

AVG METER TEMP (R) = 523.7

BAROMETRIC PRESSURE (IN.HG) = 30.13

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 2.2635

AVG. STACK VEL (FT/MIN) = 28.52499

STACK PRESSURE (IN.HG) = 30.1418

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 5.343376E-04

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 99.84558 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = .1763
SAMPLE WT. (GMS) = .1763
SAMPLE VOL. (DSCFM) = 43.11548
CONCENTRATION (GR/DSCF) = 6.309356E-02
% CO2 = 4.43
CONCENTRATION @ 12% CO2 (GR/DSCF) = .1709081
STACK DSCFM = 28432.12
PM EMISSIONS (stk conds) (LB/HR) = 15.37537
PM EMISSIONS (@ 12% CO2) (LB/HR) = 41.64887

****** END OF ANALYSIS FOR RUN # 1 ******

**************

***** RUN #2 ****

# HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 283.7055
AMBIENT WET BULB (K) = 277.5945
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 24.42685 DEG. F. VAPOR PRESSURE (IN.HG) = .1328173 SATURATION VAPOR PRESS. (IN.HG) = .374017 RELATIVE HUMIDITY (%) = 35.51102 SPECIFIC HUMIDITY (pp1000) = 2.850159

#### METER DATA PROGRAM

# OF TEST POINTS = 20 AMBIENT PRESS. (IN.HG) = 30.13

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H20
1	61	60	60.5	1.47
2	62	60	61	1.67
3	62	61	61.5	2.16
4	66	61	63.5	2.39
5	67	62	64.5	2.58
6	69	63	66	2.58
2 3 4 5 6 7	71	64	67.5	2.58
	72	65	68.5	2.47
8 9	72	65	68.5	2.58
10	72	65	68.5	2.3
11	71	66	68.5	1.5
12	71	66	68.5	1.9
13	72	67	69.5	1.9
14	72	67	69.5	2.18
15	72	67	69.5	2.38
16	73	67	70	2.57
17	74	68	71	2.68
18	74	68	71	2.7
19	75	68	71.5	2.69
20	75	69	72	2.71

FINAL AVG. METER TEMP (R) = 527.55 DELTA H@ VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 30.29908 *******************

# H20 TEST DATA

START METER READING = 294.253
END METER READING = 336.725
TOTAL CONDENSATE VOL (ML) = 82.74
H20 VAPOR GAS VOLUME @ STP = 3.921876
TOTAL METER GAS VOL (uncorrected CF) = 42.47202
AVG. METER TEMP (R) = 527.55
TOTAL DRY SAMPLE VOL (CF @ STP) = 43.04682
MOLE FRACTION DRY AIR = .9165002
% H20 BY VOL = 8.34998

#### GAS DENSITY

% CO2 = 4.57 % O2 = 15.63 % CO = 0 % N2 = 78

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GAS DENSITY = .9653274

DRY MOL. WT. = 28.8524

# ************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .313 NOZZLE AREA (FT2) = 5.343376E-04 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 30.13 STACK PRESS (IN.HG) = 30.1418 TEST START TIME = 1313

PT/DELTA P # / IN.H20	TS/TM R	VELOCITY FT/SEC		TIME MINS
1 / .15	580 / 520.5		1.47	3
2 / .17	580 / 521		1.67	
3 / .22	580 / 521.5		2.16	3
4 / .24	574 / 523.5		2.39	3
5 / .26	576 / 524.5			3
6 / .26		30.30834		3
7 / .26		30.36064		3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
8 / .25		29.82225		3
9 / .26	583 / 528.5			3
10 / .23	576 / 528.5			3
10 / .25	576 / 528.5		1.5	3
12 / .19	576 / 528.5		1.9	3
13 / .19	582 / 529.5			3
14 / .22	582 / 529.5			3
15 / .24	581 / 529.5			3
16 / .26		30.43892		3
17 / .27	584 / 531		2.68	3
18 / .27	579 / 531		2.7	3
	582 / 531.5		2.69	3
20 / .27		30.88569		3 3 3

TOTAL METER VOLUME = 42.47202

AVG. STACK TEMP (R) = 579.85

AVG. STACK VEL (FT/SEC) = 28.50638

AVG. STACK VEL (FT/MIN) = 1710.383

AVG. METER TEMP (R) = 527.55

AVG. METER DELTA H (IN.H20) = 2.2995

AVG. METER PRESSURE (IN.HG) = 30.29908

TOTAL MINS OF TEST = 60

STACK ACFM = 33583.26

STACK DSCFM = 28223.52

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#### ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 82.74

AVERAGE STACK TEMPERATURE (R) = 579.85

TOTAL METER GAS VOL (uncorrected CF) = 42.47202

AVG METER TEMP (R) = 527.55

BAROMETRIC PRESSURE (IN.HG) = 30.13

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 2.2995

AVG. STACK VEL (FT/MIN) = 28.50638

STACK PRESSURE (IN.HG) = 30.1418

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 5.343376E-04

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 100.3641 %

#### PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0

FINAL FILTER WT. (GMS) = .2177

SAMPLE WT. (GMS) = .2177

SAMPLE VOL. (DSCFM) = 43.04682

CONCENTRATION (GR/DSCF) = .0780339

% CO2 = 4.57

CONCENTRATION @ 12% CO2 (GR/DSCF) = .204903

STACK DSCFM = 28223.52

PM EMISSIONS (stk conds) (LB/HR) = 18.8767

PM EMISSIONS (@ 12% CO2) (LB/HR) = 49.56682

****** END OF ANALYSIS FOR RUN # 2 ******

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**** RUN #3 ****

## HUMIDITY DATA

ALL TEMPS INPUT IN DEGREES FARENHEIT AND CONVERTED TO DEG. K. AMBIENT DRY BULB (K) = 284.2611
AMBIENT WET BULB (K) = 278.15
SOURCE ALTITUDE (AMSL) (FT) = 870

DEW POINT = 26.14654 DEG. F.
VAPOR PRESSURE (IN.HG) = .1425087
SATURATION VAPOR PRESS. (IN.HG) = .3880618
RELATIVE HUMIDITY (%) = 36.72319
SPECIFIC HUMIDITY (pp1000) = 3.058516

## METER DATA PROGRAM

# OF TEST POINTS = 20 AMBIENT PRESS. (IN.HG) = 30.13

POINT #	TEMP IN F	TEMP OUT F	AVG TEMP F	Delta H IN.H2O
1	68	68	68	1.31
	68	<b>68</b>	68	1.81
3	69	68	68.5	2.09
4	70	68	69	2.36
5	71	<b>68</b>	69.5	2.79
2 3 4 5 6 7	72	68	70	2.67
7	74	68	71	2.57
8	74	68	71	2.77
9	74	68	71	2.65
10	75	<b>6</b> 8	71.5	2.33
11	73	68	70.5	1.81
12	73	68	70.5	2.07
13	73	68	70.5	2.18
14	73	<b>68</b>	70.5	2.37
15	74	69	71.5	2.58
16	75 75	69	72	2.78
17	75	69	72	2.88
18	, 5 75	69	72	2.87
19	75 75	69	72	2.86
20	75 75	69	72	2.65

FINAL AVG. METER TEMP (R) = 530.55 DELTA H@ VALUE = 2.11 FINAL AVG. METER PRESS. (IN.HG) = 30.30794 ******************

#### H20 TEST DATA

START METER READING = 336.853
END METER READING = 380.615
TOTAL CONDENSATE VOL (ML) = 93.58999
H20 VAPOR GAS VOLUME @ STP = 4.436166
TOTAL METER GAS VOL (uncorrected CF) = 43.762
AVG. METER TEMP (R) = 530.55
TOTAL DRY SAMPLE VOL (CF @ STP) = 44.11634
MOLE FRACTION DRY AIR = .9086316
% H20 BY VOL = 9.136842

## GAS DENSITY

% CO2 = 4.53 % O2 = 15.5 % CO = 0

% N2 = 78

GAS DENSITY = .9605196

DRY MOL. WT. = 28.7932

# ****************

# SOURCE TEST DATA

NOZZLE DIAM (IN.) = .313 NOZZLE AREA (FT2) = 5.343376E-04 PITOT FACTOR = .84 ATMOS. PRESS (IN.HG) = 30.13 STACK PRESS (IN.HG) = 30.1418 TEST START TIME = 1500

PT/DELTA P # / IN.H2O	TS/TM R	VELOCITY FT/SEC	DELTA H IN.H20	TIME MINS
1 / .13	572 / 528	21.35453	1.31	3
2 / .18	572 / 528	25.12781	1.81	3
3 / .21	579 / 528.5	27.3067	2.09	3
4 / .24	586 / 529	29.36803	2.36	3
5 / .28	580 / 529.5	31.55828	2.79	3
6 / .27	585 / 530	31.12291	2.67	3
7 / .26		30.56721	2.57	3
8 / .28	586 / 531		2.77	3
9 / .27		31.25563	2.65	3
10 / .24	594 / 531.5		2.33	3
11 / .18	574 / 530.5	25.1717	1.81	3
12 / .2	586 / 530.5		2.07	3
13 / .22	585 / 530.5		2.18	3
14 / .24	586 / 530.5		2.37	3
15 / .26	585 / 531.5		2.58	3
16 / .28		31.69402	2.78	3
17 / .29	585 / 532		2.88	3
18 / .29	586 / 532		2.87	3
19 / .29	588 / 532		2.86	3333333333333333333333
20 / .27	591 / 532	31.2821	2.65	3

TOTAL METER VOLUME = 43.762

AVG. STACK TEMP (R) = 584.05

AVG. STACK VEL (FT/SEC) = 29.43925

AVG. STACK VEL (FT/MIN) = 1766.355

AVG. METER TEMP (R) = 530.55

AVG. METER DELTA H (IN.H20) = 2.42

AVG. METER PRESSURE (IN.HG) = 30.30794

TOTAL MINS OF TEST = 60

STACK ACFM = 34682.27

STACK DSCFM = 28689.09

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# ISOKINETIC ANALYSIS

TOTAL CONDENSATE VOLUME (ML) = 93.58999

AVERAGE STACK TEMPERATURE (R) = 584.05

TOTAL METER GAS VOL (uncorrected CF) = 43.762

AVG METER TEMP (R) = 530.55

BAROMETRIC PRESSURE (IN.HG) = 30.13

AVG PRESSURE DROP ACROSS ORIFICE METER (IN.H20) = 2.42

AVG. STACK VEL (FT/MIN) = 29.43925

STACK PRESSURE (IN.HG) = 30.1418

TOTAL MINUTES OF TEST = 60

NOZZLE AREA (FT2) = 5.343376E-04

DRY GAS METER CALIBRATION FACTOR = 1.082

ISOKINETIC RATE FOR THIS RUN = 101.1234 %

## PARTICULATE EMISSION RATE

INITIAL FILTER WT. (GMS) = 0
FINAL FILTER WT. (GMS) = .0416
SAMPLE WT. (GMS) = .0416
SAMPLE VOL. (DSCFM) = 44.11634
CONCENTRATION (GR/DSCF) = 1.454989E~02
% CO2 = 4.53
CONCENTRATION @ 12% CO2 (GR/DSCF) = 3.854276E-02
STACK DSCFM = 28689.09
PM EMISSIONS (stk conds) (LB/HR) = 3.577735
PM EMISSIONS (@ 12% CO2) (LB/HR) = 9.477442

****** END OF ANALYSIS FOR RUN # 3 ******

							7					
RUN NUMBER	いなり	SCHEMAT	SCHEMATIC OF STACK CROSS SECTION	CK CROSS	SECTION	EQUATIONS		(.53.)		AMBIENT CO		<b>4</b> 0
DATE COS	1/20/5/11	1	יליב איניאו	11	0.57/1	4 <u> </u>	, 100 m	,		STATION	N PRESS	3
PLANT		7 7					Co. Co.	Ts. Vp	•	HEATE	TER BOX TEMP	
1/m m/	1 1/11/1/ L					actua		1.03014	440	0		4o
いう。	5000					-		2	<b>-</b> -	r 0 1 1 1 1	חבאו בא אבו	2
SAUPLE BOX	NyMBER									PROBE	PROBE LENGTH	L-
METER BOX NUMBER	UNDER									NOZZLE	E AREA (A)	
Qw/Qn.	7,7									, 3 2	77.	II bs
3		(,)	to ?			Stept	351.675			DRY GAS	S FRACTION (Fd)	.do
TRAVERSE	SAMPLING	STATIC	STACK	TEMP	VELOCITY	ORIFICE	GAS		GAS METER TE	TEMP	SAMPLE	IMPINGER
	TIME (min)	PRESSURE (10 H 201/A	(%F)	(Ts) (oR)	HEAD (Vp)	PRESS.	SAMPLE VOLUME	N- 0	AVG (Tm)	OUT (OE)	BOX TEMP	OUTLET TEMP
K.T.	+	2 1/1	106,		112	69"	13/56	25	5.5	150	235	1,7
	23	7(	106		5081	2.04		5.6	57	55	235	63
,v/3		7	120		2050	2.0		3	: 25	20	240	63
14:	1/2	7	<b>%</b>		177	46		6,2		7	757	
	15	5	りょう		255	2,40		7,7	1,74	te	200	
	15	9	13.5		555	2,40		25	2.5.3	100	266	00
<b>X</b> 3	7.1	<u>ک</u>	113		1255	2.52		67	(-4.5)	9.9	767	01
	24	14	7,7		いいか	1, 13 13	ķ	2000	50)	77	36.5	07
164 16	10 7 2 11	12			75,	144	213.72		2	770	3/12	12
2	36	m	70/		107	1.83	-	67	و ز	1/2	2/2	//
7.	9	<i>ħ /</i>	123		220	2.16		62	ر ا ا	100	265	6.1
0	3 42	4.5	127		, 23	2,25		AL.	5 ) <i>7</i>	( )	264	hy
4	7.	7	123		. 23	2.66		70	5.93	6.3	266	79
-	7	4	121		1,26	257		25	(,	59	7-17-2	77
4	/× //	7	9.4		27.7	17.51		2/	Ł	50	263	6.5
0	1950		120			1.57	-	0/	3		260	COT
1	27	a V	120		7/1	2007		py 1	3	200	13/	× × ×
	30					, ,	29 2.40	3	y ,	, ,	737	7
				61.635	11.511	1.2.db			63.7			
				•								

State   Stat					PARTIC	ULATE	SAMPLING DATA	A SHEET					
	RUN NUMBER	2/0/67	卜、	MATIC OF	STACK CROSS	SECTION	EQUATIONS				AMBIE		
### EACH NOT \$7 LEMP CACH THE = CMT.  ### EACH NOT \$7 LEMP CACH THE = CMT.  ### EACH NOT \$7 LEMP CACH THE = CMT.  ### EACH NOT \$7 LEMP CACH THE ### THOSE HAVE BOX TEACHER ### THOSE HAVE BOX TEACHER #### THOSE HAVE BOX TEACHER ####################################	25.24.35	JEN BOILE	_	7	;		(E,	9			2		01
## EL PLITAIT SCOT B. C. U.  ## EL PLITAIT STATE HOLD THE STATE HOLD THE PROSE LEAVEN  ## FEL PLITAIT STATE HOLD THE STATE HOLD THE PROSE LEAVEN  ## FEL PLITAIT STATE HOLD THE STATE HOLD	١	2187	37	#tr C/	ra im	\I	<u> </u>	2			STATE SC.	ON PRESS	: :
### FOR HATTER  #### FOR HATTER  #### FOR HATTER  #### FOR HATTER  #### FOR HATTER SETTING  #### FOR HATTER  ##### FOR HATTER  #### FOR HATTER  ##### FOR HATTER  ##### FOR HATTER  ##### FOR HATTER  #### FOR HATTER	PLANT	TINTI	7	700	184°	(4)	<del> </del>	: 			HEATE	R BOX TEMP	
##TER BOX WUMBER  R HC  NUTS CH  NUTS C	BASE	<b>~</b>		.		<b>:</b>					PROBE	HEATER SETT	
######################################	SAMPLE BOX K										PROBE	LENGTH	
Company	RH	Ĵ	<del></del>								,	55117	9
Co. 547 (20)  Co	METER BOX N	UMBER KCH									NOZZL 313,	F AREA (A)	
Sampling   State Team   State	<b>0</b> €/ <b>0</b> ⊞										١.	128	
TRAVERSE SAMPLING PRESSURE (TR) (TR) (TR) (TR) (TR) (TR) (TR) (TR)	3		W	June	12			394.3	5		ORY S	AS FRACTION (F	(þ.
	TRAVERSE	SAMPLING	STATIC	_	ACK TEMP	VELOCITY	ORIFICE	GAS	GAS	METER	EMP	SAMPLE	IMPINGER
	POINT	TIME (min)	PRESSURE (10 H 20)	٠,		HEAD (Vp)	PRESS.	SAMPLE VOLUME	N (F)	AVG (Tm) (OR)	OUT (OF)	BOX TEMP	OUTLET TEMP (OF)
1		1 1	11.	+ +		./5	1.47	204.143	19	(4), 5	103	741	
	2	~\.	7	7		),,	1.9.1		47	Ē	00	797	19
12   5   16   12   2.58   65   645   25   25   25   25   25   25   25		2	1	J		100	2000		100	5/5	13	164	25
1   5   6   173   2.1   2.5   5   174   10.5   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175   175		, 2	4			1/3	2:56		200	(3)-C	2	26.0	
1	7	51	1	6//		10	25.2		67	50	iù	747	49
1	7	٠, ۶	9	121		77.	<u>`</u>		1/1	67.5	100	26.7	66
	r	12	9	123		7	3-		75	29	50	2:22	99
SEIGHS   ST   1/9   1/10   7/1   1/2   1/2   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1/3   1	0/	72			7	1/	1/2	162	72		59	NV	550
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1.27 2.69 75 11.58 25°C 6 1.27 2.71 336.725 75 12 6.9 25°C 6 3.30 Now 11.54 2.30 43.473 75.118	8	21		119		1.7'	2.70		HC	14	6.3	252	
30 (1.54) 1.27 2.71 336.725 75 72 6.4 25.7 6 336.725 75 72 6.4 25.7 6	1,	14		771		.27	7		75	7.5	20	1,	100
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7 119.95		95:	1	+	1		193	356.72		1,	1 617		
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CONTROL CONTRO

FORM 18 OEHL

						PARI	ICULATE SA	PARTICULATE SAMPLING DATA SHEET	A SHEET					
	THE STATE OF THE S		<u>×</u>	HEMATI	C OF STA	SCHEMATIC OF STACK CROSS SECTION	ECTION	EDUATIONS				AMBIEN	AMBIENT TEMP	
	A616, 313 A	18/13/3/18/118K	1	アンサン	× #			0				THE STATE OF THE S	15/2	3 3
	ATE	1	1	3	7.			X   1 460	20			STATIO	Z	
-	227	115051	1	¥¥2	TY CK 62 1 12	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	, , , , , , , , , , , , , , , , , , ,	:	5130.Fd.Cp.A 2	Tm.		×	8	In High
1-	FLANT					,	•			T _S		HEATE	HEATER BOX TEMP	
	THE THE	LW.	_					<i>V</i>				10000	WILLIAM OF ALL ALL ALL ALL ALL ALL ALL ALL ALL AL	Ao
- ,	HASE /- 1 >	H	$\omega$					<u></u>	THE TOTAL PROPERTY OF THE PARTY	K		1	MEN EN SE I I	2
	AMPLE BOX'N	7.//						1.6 B J. C.	)	•		PROBE	PROBE, LL.NGTH	
	RIK.	ر	<del></del>					<u>,                                    </u>				\ <u>\</u>	554179	2
<u> </u>	< -	NUMBER						<u> </u>				NOZZLE	E AREA (A)	
	*/ 3//	777							]				15/5/5/	Sq ft
	: >											$\sim$	1/2	
<u> 1                                   </u>	0			Jr4/	75							DRY GAS	S FRACTION (Fd)	d)
<b>-</b>	TRAVEHSE	SAMPLING	STAT	نِ	STACK TEMP	TEMP	VELOCITY	ORIFICE	GAS	GAS	GAS METER TO	EMP	SAMPLE	IMPINGER
	POSINI	TIME	PRESSURE (10 H.20)	J. C.	(0F)	(Ts)	HEAD (VD)	DIFF. PRESS.	SAMPLE	ž	Avc (Tm)	out	BOX TEMP	OUTLET
			1110	45		(SR)	(4.)	(H)	(2 E)	(0F)	(0R)	(0F)	(OF)	(OF)
<u> မ</u> မ	1.	7,7,7	2	7	1.			٠,	226.825	CON	300		230	( )
<u> </u>	7	1		7	1/4		010	1.00		60	3	70/2	777	6.7
14	5	17		+	121		77.	75.7		1/1/	300	0 35	750	(,)
4	7	21		1	27		2.5	7		1/2	5 0:	22	756	6.7
	)	7.5		7	125		12'	2.67		77	70		263	63
	7	/,5			126		,26	2.57		74	1/	0.7	248	68
	'م		8		7-71		2.8	7.6.7		74	, ,	63	1252	68
	21	24	<b>لم</b> ار	,	150		7,7	2.65	Ì	4	17	S. S	, 7	200
\	<u> </u>	\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		1	1 1 1		10/2	1.81	273,85	27.	, v	22	2/2/	200
L .	7	3			126		170			33	2002	187	757	20
L Z	3	9		// /	125		777			23	70.5	37	273	89
	7	7	,7		126		,24			23	5.0%	89	. 13	イッ
	^	2/	"		125		.26	7,58		74	71.6	63	25.3	6.5
	ę	15		9	125		1/2	2.78		75	7.7	6.9	152	89
		^			57		120	2.88		75	7.7	63	250	65%
	0	7.	9	7	7,		.20	2.81		25	7.5	64	25%	63
_	1	7.7	9 /	7	25	1	,74	7.86		75	7:	69	250	65
_	10	27	9 /	7	130		127	2.65		75	123	64	7.57	89
		30	<u>-</u>	+		Ŧ			380.615			+		
				+	\$	40	40. 1.0	742	0076.54		701.27			
J	DEML FORM	٩		1	1		1		<b>X</b>				/ [[	
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CONTRACTOR CONTRACTOR DECORPORATION DE CONTRACTOR DE CONTR

	AIR POLLI	UTION PARTICUL	ATE ANAL	YTICAL	DATA	
	Scrubbe	ATE			RUN NUMBER	7
BUILDING NUMBER			SOURCE NUM	BER		
1.		PARTICUI	ATES			
<del></del>	ITEM	FINAL WE		INITi	AL WEIGHT	WEIGHT PARTICLES
FILTER NUMBER		0,29	97	0.	2766	0.023/
ACETONE WASHING Hall Filter)	S (Probe, Front	100.2	818		1286	0.1532-
BACK HALF (If need	led)					
		Total Wei	ght of Particu	lates Colle	cted	0.1763
11.		WATE	R			
·	ITEM	FINAL WE	HGHT	INITI	AL WEIGHT	WEIGHT WATER (@m)
IMPINGER 1 <i>(H20)</i>		117	,	/0	90	17
IMPINGER 2 (H20)		145		10	0	45
IMPINGER 3 (Dry)		2		0	1	2
IMPINGER 4 (SILICA (	237,4 tau21.3	216	10	20	4.97	11.13
e de la companya de l		Total We	ight of Water C	Collected	•	75,13
181.		GASES	(Dn)			
ITEM	ANALYSIS 1	ANALYSIS 2	ANAL		ANALYSIS 4	AVERAGE
VOL % CO2	4.6	4.3	4,	4		4,43
VOL " 0 ₂	15.2	15.1	15	. 0		15.1
VOL + CO						
VOL " N2						
		Vol % N2 = (100% - %	CO2 - % O2 -	% CO)		

	AIR POLI	LUTIC	ON PARTICUI	LATE ANA	LYTICAL	. DATA		
PASE		DATE				RUN NUMBER # 9	<b>,</b>	
So with this A	12# W K	, #	2	SOURCE NU	MBER			
Sometine 1	0 7 10	<del></del> -	- TABTIC					
1.			PARTICE FINAL W	ULATES WEIGHT	INIT	IAL WEIGHT	<del></del>	VEIGHT PARTICLES
17	ITEM		FINAL W		1711	IAL WEIGHT	<b></b>	VEIGHT PARTICLES
FILTER NUMBER			0,30	)85	0.	2772	(	0.0313
ACETONE WASHINGS Hall Filter)	(Frobe, Front		99,8	200	ļ	6/36		0,1864
BACK HALF (II needed	id)	_						
			Total W	feight of Partic	culates Call	ec ted	0,	2117
11.			WAT	TER	<del></del>			
1*	ITEM	-	FINAL W		TINI	IAL WEIGHT (gm)		WEIGHT WATER (4年)
IMPINGER 1 (H20)			126	)	18	30		26
IMPINGER 2 (H20)			134	/	100	D		34
IMPINGER 3 (Dr)		_	6,4	·	0			6.4
IMPINGER 4 (SIIIca Ge	21.3		222.80 206.46 16.3				16.34	
180 180,0 10 10.0 0.5 0.50			Total W	feight of Water	Collected		5	82.74
111.		<del></del> -		\$ (Dry)		T		
ITEM	ANALYSIS		ANALYSIS 2		L YSIS 3	ANALYSIS 4		AVERAGE
vau + co _i	4.6		4.6	4.	5			4,57
vol+ o _i	4.6 15.6	/	15.8	15	,5			15.63
VOL . CO								
VOL " N ₂								
		Vol	% N ₂ = (100% - %	€ CO ₂ - % O ₂ -	- % CO)	1		

THE COURSE CONTRACTOR CONTRACTOR

	AIR POLLUT	ION PARTICUL	ATE ANA	LYTICAL	DATA	
BAR3	Scrubber	E	<del></del>		RUN NUMBER	·)
BUILDING NUMBER			SOURCE NU	MBER		
l	<del></del>	PARTICU	LATES			· <u> </u>
ı	TEM	FINAL WE		INITI	AL WEIGHT (gm)	WEIGHT PARTICLES
FILTER NUMBER		0, 30,	//	0.0	2772	0.0239
ACETONE WASHINGS Half Filter)	(Probe, Front	97.6	740	97.	. 6563	0,0177
BACK HALF (II neede	ed)					
		Total We	ight of Partic	culates Colle	cted	0.0416 .
II.		WAT	ER			
ı	TEM	FINAL WE		INIT	ALWEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)		158		100	`	58
IMPINGER 2 (H20)		118		100		18
IMPINGER 3 (Dry)		4	<del></del>	0		4
IMPINGER 4 (SIIIca G	IMPINGER 4 (Silica Gel)			215. <b>9</b> 202.31		13.59
	Samuel Samuel Samuel Samuel	<u> </u>	Total Weight of Water Collected			93.59 -
m.	<u></u>	GASES	T			
ITEM	ANALYSIS	ANALYSIS 2	ANA	L YSIS 3	ANALYSIS 4	AVERAGE
۷٥١ % ۵٥ ₂	4.4 <del>7.6</del>	4.6	4.	,6		4.53
VOL % 0 ₂	20.06	15.5	2	5.4		4.53 15.5
VOL % CO						
VOL T N ₂						
	٧٥	1 % N2 = (100% - %	CO2.%O2	- % CO)		

SECOND PROPERTY PARTIES CONTRACTOR CONTRACTO

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APPENDIX I

EPA Computer Program Emission Calculations

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### METER BOX 17 100% PRO MINESES ### PROFESSOR ### PROFES		XRON -METH-5-		NRON METH 5
### PROFES PLAY 1   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1,1282   1		RUN HUMBER	XROH - HASSFLGA	
## NET CONTROL   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000		RUN	RUN HUNSER	
BATT NO PROSEST 1,7299 BM			93-09-04-s	1.8829 RUN
BOD PRESS 2 - 4-50 MAY STORY 3-15 BUY BOX PRESS 7 - 4-50 MAY STORY 3-15 BUY BOX PRESS 7 - 4-50 MAY STORY 3-15 BUY BOX PRESS 7 - 4-50 MAY STORY 3-15 BUY BOX PRESS 7 - 4-50 MAY STORY 3-15 BUY STORY 3-15		BELTA H?	RIJN	
## RETER VO. 33.7379 RM				
## FETCH VO. 33,7310 BUN		29.42 <del>09</del> RUN		
First   Top			12,208.99 RUH	
STATIC LIMIT IS 1999				NTR TEMP F?
STOCK TEPP, 2599 ROW  (28, New Tep 129) ROW				
### STACK TEPE. ### 49.8000 RM F GOV/SCF = 8.11 RL NOTER 5.6 RM F F GOV/SCF = 8.11 RL NOTER 5.6 RM F F GOV/SCF = 8.11 F F LAW = 11.12 F LAW =			RUN	.0900 RUM
## NOTES   1909   100		STACK TEMP.		
Time   10   10   10   10   10   10   10   1				ML. WATER ?
Time   2 Noise   5.6   Time   2 Noise   6.8				68.34 <del>80</del> RUN
2 KDH=5.6  2 CO2?  10.1700 FUH  2 COYCEN?  9.1700 FUH  9.1700				•
\$ 2 MBH=5.6  \$ 2 CO2?  \$ 18.1700 PUM \$ 2 COYCEN?  \$ 2 COY				
\$ 1001-5.6  \$ 2 CO27  \$ 3 CO27  \$ 2 CO27  \$ 2 CO27  \$ 3 CO27  \$ 2 CO27  \$ 2 CO27  \$ 3 CO27  \$ 2		IMP. % HOH = 5.6		IMP. 2 HOH = 6.8
2 CO22 2 COYYGEN 9.3788 PUN 2 COYYGEN 9.3788 PUN 3.00 PUN				2 HOH=6.8
2 COYGEN? 2 COYGEN? 3,2788 PRIN 2 COYGEN? 2 CO? PRIN  2 CO? PRIN  2 CO? PRIN  104-39,489 PRIN  105-8999 PRIN  106-8999 PRIN  106-8999 PRIN  106-8999 PRIN  107-107-107-107-107-107-107-107-107-107-		Z HUH=3.6		
2 COYTGEN? 2 COYTGEN? 3,2788 PRIN 2 COYTGEN? 2 COYTGEN? 2 COYTGEN? 3,2788 PRIN 2 COYTGEN? 3,2788 PRIN 2 COYTGEN? 4 COYTGEN? 5 COYTGE		* rn22		2 CO2?
2 COT CEPT  2 CO ?  RUM  PM4 = 39.89 PM MET=29.33  SART PSTS ?  SART PSTS P  6.899 PUM  MOZZLE BIA ?  66.899 RUM  WOZZLE BIA ?  66.899 RUM  WOZZLE BIA ?  66.899 RUM  PM3  STR DIA INCH ?  66.899 RUM  PM3  ** VOL. HTC 2TB = 29.477 STK PSTS PSTS = 24.42 STK PSTS PSTS = 24.42 STK PSTS PSTS = 24.42 STK PSTS PSTS PSTS = 24.42 RUM INCH PST PSTS PSTS ?  ** VOL. HTC 2TB = 29.477 STK PSTS PSTS PSTS PSTS PSTS PSTS PSTS P				19.6700 RUN
### 139.88 MM ## 129.83 MM ## 1		2 OXYGEN?		
RIM # # # # # # # # # # # # # # # # # # #				% CO ?
### MET-29, 21  SORT PSTS ? 6, 2913 RUM  TITE HIM ? 68, 8888 PUH  MOZZLE JIA ?  STK DIA INCH?  FUN  ***YOU. MIT STD ?  STK DIA INCH?  ***OU. MIT STD ?  ST MIN NUMBER SP .94 2  VIN MUM CAS = 2, 25  VIN MUM CAS = 2, 26  V				RUM
SART FSTS ?  6.2913 RUN  TITE FIN ?  6.0000 RUN  MOZZE BID ?  6.0000 RUN  **YOU HIR STD = 39.472  STK PES 805 = 29.42  VOL HON GOS = 2.36  Z MOIL MOR DEV = 5.63  MOIL DEV GOS = 0.944  Z HIFDOCEN = 69.464  A HIF DEV = 39.600  MOIL HI DEV = 39.300  MOIL HI DEV = 39.300  FRONT 1/2 MC STR  STOCK RECT = 21.924.  **STOCK RECT = 12.202.  **STOCK RECT = 12.202.  **STOCK RECT = 12.202.  **STOCK RECT = 21.924.  **STOCK RECT =		MM-39.69		
6.8854 RUN  TITRE HIM ? 66.8888 PUN  MOZZLE BIR? 4998 RUN  STY DIR INCH? 66.8889 RUN  **VOL HIP STD = 39.478  STY PPES RBS = 29.42  VOL HIP STD = 39.478  ST NOISTUPE = 5.63  MOL BY COS = 2.36  Z NOISTUPE = 5.63  MOL BY COS = 2.944  Z NITPOCCH = 88.46  MOL HI PS = 38.69  MOL HI PS = 18.78  STACK ROCH = 21.264  **STACK ROCH = 12.228. **STACK ROCH = 11.26  F KOMPH = 5.38  END OF FIELD BATTA  **STACK ROCH = 11.269. **STACK ROCH = 21.269. **S				Mi NET=29.21
6.8854 PUN  TITRE HIM ? 66.8888 PUN  MCZTLE BIR? 4998 RUN  STX DIA INCH? 66.8889 RUN  **VOL HIP STB = 39.47P  STK PES RBS = 29.42  VOL HIP STB = 39.47P  ST WIN HUMBER  **VOL HIP STB = 49.49P  **VOL				6007 DATA 0
TIRE HIS 96.0000 RUN				
## MOZZLE BIR ?  ## MOU HIP MOZLE BIR ?  ## MOU HIP				TIME HIH ?
### STEAL BIR 19.00  - VOL HTP STD = 39.478  STK PES RBS = 29.42  VOL HTP STD = 39.478  STK PES RBS = 29.42  VOL HTP STD = 39.478  STK PES RBS = 29.42  VOL HTP STD = 38.842  STK PES RBS = 29.42  VOL HTP STD = 38.842  STK PES RBS = 29.37  VOL HOH GGS = 2.36  Z HOISTUPE = 5.63  MOL DPY CBS = 6.944  Z HITPOCH = 80.46  MOL HT DPY = 30.60  STROK REPR = 21.76  STROK REPR = 21.76  STROK REPR = 23.76  STROK REPR = 23.76  STROK REPR = 23.76  STROK REPR = 21.269.  Z ISOKINETIC = 94.72  F COMMM = 273.62  Z ISOKINETIC = 94.72  F LB PR = 11.56  F KOMM = 273.62  END OF FIELD BATA		60.0000 RUH	XROM -MASSELQ-	
STX DIG INCH?  60.8000 RUN  * VOL MTR STD = 39,478  STK PESS ABS = 29,42  VOL MON GGS = 2,36  Z NISTURE = 5,63  MUL DPY GGS = 8,944  Z NISTURE = 88,46  MGL NT DPY = 38,80  MGL NT DPY = 29,21  MGL NT DPY = 29,21  MGL NT DPY = 38,80  MGL NT DPY = 29,21  MGL NT DPY = 29,21  MGL NT DPY = 38,80  MGL NT DPY = 29,21  MGL NT DPY = 29,21  MGL NT DPY = 29,21  MGL NT DPY = 28,80  MGL NT DPY = 28,80  MGL NT DPY = 38,80  MGL NT DPY = 29,21  MGL NT DPY = 28,80  MGL NT DPY = 2			•	14980 RUN
**OUL HIR SIB = 39.478 SIK PRES ABS = 29.42 VOL HOR LOS = 2.36 X MISTURE = 5.63 HOLDRY CAS = 8.944 X HIFFORM = 80.46 MIGHT BYF = 38.69 STACK ABCAF = 22.37 STACK ABCAF = 22.37  **STACK ABCAF = 21.2924. **STACK ABCAF = 21.2924. **STACK ABCAF = 21.2928. **TACK ABCAF = 21.2924. **STACK ABCAF = 21.2926. **TACK ABCAF = 21.2926. **TACK ABCAF = 21.2926. **STACK ABCAF = 21.2926. *		STK DIG INCH ?		
**VOL HIR STB ?**  STK PPES RBS = 29.42  VOL HOR CAS = 2.36  VOL HOR CAS = 2.376  VOL HOR CAS = 2.36  VOL HOR CAS = 2.37  VOL HOR CAS = 2.36  VOL HOR CAS = 2.37  VOL		66.0009 RUN		
SIK PRES MBS = 29.42  VOL HOH CAS = 2.36  2 MOISTUPE = 5.63  NOL BOP CAS = 8.944  2 MITPOREM = 88.46  NOL BOP CAS = 8.944  2 MITPOREM = 88.46  NOL BOP CAS = 8.945  388.39  RUY  MOL NT WET = 29.33  VELOCITY FPS = 15.38  STACK AREA = 23.76  STACK AREA = 23.76  STACK AREA = 21.824.  STACK SECTH = 11.289.  7 ISGNIMETIC = 94.72  EMP OF FIELD PATA  151  151  151			VOL MTR STD ?	
### 27 NO STURE 5.63  ### 35 NO STURE 5.63  ### 36 NO STURE 5.64  ### 36 NO STURE 5.64  ### 36 NO STURE 5.65			38.842 RUN	
MOL DPY COS = 8.944  2 NITPOCEM = 88.46  389.38  MOL NT DPY = 39.69  MOL NT DPY = 39.69  MOL NT WF = 29.33  VELOCITY PPS = 15.78  STACK ARGE = 23.76  STACK ARGE = 23.76  STACK REFM = 21.924.  STACK FSCFM = 21.924.  STACK PSCFM = 21.924.  STACK PSCFM = 12.298.  7 ISOKINETIC = 94.72  F B.PAR = 11.86  F KG-MF = 5.38  EMS OF FIELD DATA  151  151				% MOISTURE = 6.81
### ### ### ### ### ### ### ### ### ##		MOL DRY CAS = 8.944		
MOL ST MET = 29.33  VELOCITY FPS = 14.91  VELOCITY FPS = 14.91  STRICK RRER = 23.76  STRICK RREM = 21.924,  STRICK RREM = 12.229.  STRICK RREM = 12.229.  STRICK RREM = 12.229.  STRICK RREM = 12.229.  STRICK RREM = 11.596.  STRICK RREM = 12.229.  STRICK RREM = 11.596.  STRICK RREM = 11.596.  STRICK RREM = 21.726.  STRICK REM = 21.726.  STRICK RREM = 21.726.  STRICK			309.30 RUY	NOL NT DRY = 30.93
STACK AREA = 23.76  STACK REF = 21.924.  • STACK PEF = 12.289.  • STACK PEF = 21.289.  • STACK PEF = 21.299.  • STACK PEF = 21.289.  • ST		MOL MT WET = 29.33		
STRCK RCFM = 21,924.  STRCK PSCFM = 12,229.  STRCK PSCFM = 12,229.  STRCK RCFM = 21,269.  STRCK BCFM = 11,596.  STRCK BCFM = 11,596.  STRCK BCFM = 11,596.  STRCK BCFM = 11,596.  STRCK BCFM = 21,269.			P. C. 18	
• STACK PSCFM = 12,200.  2 ISOKINETIC = 94.72  F NO.MMM = 273.02  F NO.MMM = 273.02  F LB./HR = 11.26  F KO./HF = 5.30  END OF FIELD DATA  151			F 60 (0005 - 0.40	STACK ACFM = 21,269.
F LB/HR = 11.86 F KC/HF = 5.39  EMB OF FIELD DATA  END OF FIELD DATA		• STACK PSCFM = 12,208.		
EMB OF FIELD PATA  END OF FIELD PATA  151		7 ISGNINETIC = 94.72	F LB/HR = 11.86	# soomments = Notif
151			F KG/HR = 5.39	END OF FIFED DATA
		EMD OF FIELD DATA		END W. I SEED PRIN
			151	
ĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸĸ				
ᢏ᠁ᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎᡎ				
	e nemente en en en en en en	Geografia	ሊያነላ፤ ቀር የእና ቀር የእና የር የሌ የላይ የላይ የላይ የላይ የ	ዸኇዹፇጜዄዄዀዀቔፙኇዹኯ፟ዹፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙፙ

##00m - ur				XRON -MS	TH 5-
XRON AME PUN NUMBER				RUN HUMBER	
B3-BD-R5		XRON - MAGGE LO		.,83 SC-R	
	Pitte	BUIL MASSS		METER BOX Y?	RUN
METER BOX Y?	•	RUM NUMBER - <del>83-89-83</del>		1.8820	RUN
1.0820	PUH	RUN		DELTA H?	KUN
BELTA H?				2.8399	RU4
1.5909	RUN	VOL HTR STD ?		BAR PRESS ?	
BAR PRESS ?	Deni	38.431 PUN		<b>29.82<del>89</del></b>	RUY
29.2099 METER VOL ?	Kiih	STACK DSCFM ?		METER VOL ?	
34.1998	RUN	11,499.00 RUN		47.3249	RUH
MTR TEMP F?		FRONT 1/2 MG ? 381.20 RUN		HTR TEMP F? 57.0000	
38.1399	RUH	381.20 RUN BACK 1/2 MG ?		Z OTHER CAS	RUN
STATIC HON IN ?		RUH		REMOVED BEFORE	
.0700	PUH			DRY CAS METER ?	
STACK TEMP.				•	RUN
437.7890	RUN	F CR/BSCF = 0.15		STRTIC HOW IN ?	
ML. HATER ? 56.7588	PHS	F MG/MMH = 350.28		.1299	RUM
30.1300	k1)**	F LB/HR = 14.97		STACK TEMP.	
		F KG/HR = 6.79		112.9 <del>990</del> ML. WATER ?	RUN
				60 Ann	Butt
					RUN
IMP. $2 + 00 = 6.5$				SAT 2 = 9.7	
				THP. 2 HOH = 6.9	
% HOH=6.5				- 11011-C 0	
				2 HOH=6.9	
2 CO2?					
10.1999	RUN			t CO2?	
% OXYGEN?				3.3700	RUN
8.5399	RUN			₹ DXYGEN?	
% CO ?				16.83 <del>99</del>	RUH
	RIJN			% CO ?	
WII 44 44					Ruh
MNd =29.96 MN WET=29.18	1			MOL MT OTHER?	Bun
TH MC1-27.10					RUN
	1			MWd =29.21	
SORT PSTS ?				MH MET=28.44	
6.9611	RUH			SORT PSTS ?	
TIME MIN ?				12.8199	RUN
60.0000	RUN			TIME HIH ?	
HOZZLE DIA ?	BIIU	RUN NUMBER		68.8999	RUN
.4980 STK DIA INCH?	RÚN	B3 SC R1	RUN	HOZZLE DIA ?	B
66.8989	RUH		KUT	.3139	RU₩
00.0000	-0	VOL MTR STD ?		STK DIA INCH ? 60.0000	RUS
. VOL MTR STB = 38.	431	51.085	RUN	00.0000	V.53
STK PRES RBS = 29	.21	STACK DSCF# ?		. VOL MTR STB = 51.	.085
VOL HOH GAS = 2.6		31,392.00	RUN	STK PRES ABS = 29	
t MOISTURE = 6.59		FRONT 1/2 MG ?		VOL HOH GAS = 3.8	39
MOL BRY GOS = 8.9		1,147.09	RUN	2 MOISTURE = 6.93	
% HITROGEN = 81.3 MOL NT DRY = 29.9		BACK 1/2 MG ?	D:IV:	MOL DRY GAS = 0.1	
MOL WY NET = 29.1			RUS	2 NITROGEN = 79.4	
VELOCITY FPS = 14				NOL NT DRY = 29.0 NOL NT HET = 28.0	
STACK AREA = 23.70		F CR/DSCF = 0.35		VELOCITY FPS = 3	
STACK ACFM = 21,2		F MG/MMM = 792.98		STACK AREA = 19.0	
* STACK DSCFM = 11.4		F LB/HP = 93.23		STACK ACEM = 37.	
% ISOKIHETIC = 3:	8.67	F KG/HR = 42.29		* STACK BSCFM = 31	
				Z ISOKIHETIC =	99.72
END OF FIELD DATA					
THE OF FIGURERS				EXO OF FIELD DATA	

XRON -HETH-5-	•	
83:SC-R2#		XPOR PRESIDE
RUN NETER BOX Y?	XRON *MASOFto	RUN HUMBER -B3-SD-R3-
1.9820 RUN Belta M?	RUN NUMBER	METER BOX Y?
2.8975 RUN BAR PRESS ?	RUN	1.0920 RUN DELTA H?
29.8289 RUN METER VOL ?	VOL MTR STD ?	2.9575 RUN BAR PRESS ?
47.5820 RUN NTR TEMP F?	50.54 RUH STRCK DSCFM ?	29.8200 RUN METER VOL ?
65.3989 RUN STATIC HOW IN ?	31,892.80 RUN FRONT 1/2 MG ?	48.98 <del>98</del> Run
.1200 RUN	492.60 RUN 492.60 RUN	HTR TEMP F? 72.5380 RUN
STRCK TEMP. 112.1909 RUH	RUH	STATIC HON IN ?
ML. MATER ? 81.6300 RUH	F GR/BSCF = 8.12	STACK TEMP. 120.8900 RUN
SAT 2 = 9.5	F MG/MMM = 281.31 F LB/HR = 32.67 F KG/HR = 14.82	ML. NATER ? 82.2689 RUM
IMP. 2 HOH = 7.1		SAT 2 = 12.1
% HOH=7.1		IMP. % HON = 7.8
4 1017-111		% HOH=7.0
% CO2? 3.0300 RUN		* 110n-7.8
2 OXYGEN?		z coz?
17.3000 RUN 2 CO ?		3.1899 RIJN * OXYGEN?
RUK		17.8899 RUM 2 CG ?
MW 4ET=28.39		RUN
		MHd =29.18 MN NET=28.39
SORT PSTS ? 12.6409 RUN		
TIME MIN ? 60.0000 RUN	XROM -MASSEE	SQRT PSTS ? 13.0836 RUN
HOZZLE DIA ?	RUN NUMBER	TIME MIN ? 69.8639 RUN
STK DIR INCH ? 60.0000 RUN	rbose <del>rks</del> → round	HOZZLE DIA 2
• VOL MTR STB = 58.548	VOL HTR STD ?	STK DIA INCH ?
STK PRES ABS = 29.03	51.272 RUN STACK DSCFM ?	60.8888 RUN
VOL HOH GRS = 3.84 2 HOISTURE = 7.87	31,619.00 RUN FRONT 1/2 NG ?	• VOL MTR STB = 51.272 STK PRES ABS = 29.83
MOL DRY GRS = 0.929 % HITROGEN = 79.67	383.38 RUN BACK 1/2 MG ?	VOL HOH GRS = 3.87 Z MOISTURE = 7.82
MOL NT DRY = 29.18 MOL NT MET = 28.39	RUN	MOL DRY CAS = 8.938 2 NITROCEN = 79.98
VELOCITY FPS = 31.62 STACK AREA = 19.63	F GR/DSCF = 0.09	MOL HT DRY = 29.18 MOL HT HET = 26.39
STACK ACFM = 37,254. * STACK DSCFM = 31,882.	F MG/MMM = 208.90 F LB/HF = 24.74	VELOCITY FPS = 32,73 STACK AREA = 19.63
2 ISOKIHETIC = 99.98	F KG/HP = 11.22	STACK ACFM = 39,556. * STACK BSCFM = 31,619.
END OF FIELD DATA		2 ISGKINETIC = 99.37

XRON JANE	TH.			XRON STATE	-نائن
RUN HUMBER 84-89-RF				RUN HUMBER	
0+0-x:	RUN	XROM : MAS	حص		RUN
METER BOX Y?	RUN	RUN HUMBER		METER BOX Y? 1.8829	Rija
1.6828 BELTA H?	KUN	B4-Bi	CLX	DELTA H?	
1.4699	RUH		RUH	1.6525 BAR PRESS ?	RUN
BAR PRESS ? 30.3399	RUH	VOL MTR STD ?		39.3399	RUH
METER VOL ?	Bitto	37.618	RUN	METER VOL ? - 35.5389	RUN
32.9920 MTR TEMP F?	RUH	STACK DSCFM ? 11,024.00	RUN	MTR TEMP F?	NUIT
49.7198	RUN	FRONT 1/2 MG ?	KUN	56.6788 STATIC HOW IN ?	RUM
STATIC HOW IN ?	RUN	413.90 BRCK 1/2 MG ?	RUN	.1100	RUN
STACK TEMP.	Resu	OHCK 1/2 NG :	RUN	STACK TEMP. 413.8888	RUH
419.3 <del>000</del> ML. NATER ?	RUN			ML. WATER ?	KUP
58.4299	RUN	F GR/DSCF = 0.17		65.5 <del>190</del>	RUN
		F NG/HMM = 389.55			
		F LB/HR = 16.84 F KG/HR = 7.28			
IMP. % HOH = 6.8				IMP. 2 HOH = 7.2	
% HOH=6.8				% HOH=7.2	
z C02?	••••			ኔ CO2?	<b>S</b> INL
9.1300 % DXYGEN?	PUN			9.3300 2 OXYGEH?	RUH
9.2000	RUN			19.1999	RUN
% CO ?	RUN			\$ CO ?	RUH
MWd =29.83				NNd =29.98	
MN NET=29.82				NV NET=29.04	
SORT PSTS ?	<b>D</b> UN.			SURT PSTS ? 5.9381	PUN
5.6318 TIME MIN ?	RUN	XROM MA	COSELO:	TIME MIN ?	FUN
69.099 <del>9</del>	RUN	DULL LUMBER		60.0 <del>000</del> Hozzle dia ?	RUN
NOZZLE DIA ?	RUH	RUN NUMBER <del>84-82-8</del>		.4988	PIJN
STK DIA INCH ?	Belle		CLY Run	STK DIA INCH ?	PUN
66.8999	RUH		KUM	66.8 <del>988</del>	FUR
• VOL NTR STD = 37.6		VOL MTR STD ? 39.993	RUN	• VOL MTR STD = 39. STK PRES ABS = 39	
STK PRES ABS = 30. VOL HOW GAS = 2.75		STACK DSCFM ?	רטא	VOL HOH GAS = 3.0	
% MOISTURE = 6.81		11,659.09	RUK	Z MOISTURE = 7.16	
MOL DRY CAS = 0.93		FRONT 1/2 MG ?	Olik	MOL DRY GAS = 0.9	
% HITROGEN = 81.67 MOL NT DRY = 29.83		553.89 BACK 1/2 MG ?	PUH	% NITROGEN = 80.5 MOL NT DRY = 29.9	
MOL MT WET = 29.03			Bill:	NOL NT NET = 29.0	
VELOCITY FPS = 13.				VELOCITY FPS = 14	
STACK AREA = 23.76				STACK AREA = 23.7	
STACK ACFM = 19,42		F GR/DSCF = 0.21		STACK ACEM = 20.4	
* STACK DSCFM = 11,6		F MG/HMM = 489.81 F LB/HR = 21.36		* STACK DSCFM = 11, % ISOKINETIC = 1	
Z ISOKINETIC = 99	7. 73	F KG/HF = 9.69		* ISONINETIC = 1	CU. 79

	XROM = <del>Neih-</del> *	•		Vons	-
	RUN HUMBER B4 BP R3			XRON -N RUN HUNDER .84 CC RIN-	C111 )-
5	RUI METER BOX Y?	XROM "H	<del>89971,9~~</del>	HETER BOX Y?	RUH
E	1.0020 RU BELTA H?	N RUN NUMBER	-	1.8829 BELTA H?	RUN
STATULE	1.5200 PU	BY BP R3	RUN	2.2699 BAR PRESS ?	RUH
8	39,3390 RUI METER VOL ?	VOL MTR STD ?	WVII	39.1300 METER VOL ?	RUN
	34.5919 RUP HTR TEMP F?	ⁱ 38.228	Bilm	42.2339 MTR TEMP F?	RUN
	65.9600 PUN STATIC HOW IN ?	11,000.00	RUN	63.7080	RUN
k S	.1100 PUN STRCK TEMP.	337.30	RUN	STATIC HOW IN ?	RUH
8	428.9800 RUN NL. WATER ?	BACK 1/2 MG ?	RUN	STACK TEMP. 120.5000	RUN
•	69.3699 RUN			ML. NATER ? 75.1300	RUN
		F CR/BSCF = 0.14 F MG/HHH = 309.0 F LB/HP = 12.81 F KG/HR = 5.01		SAT 2 = 11.6	
8	IMP. 2 HOH = 6.9			IMP. % HOH = 7.0	
	Z HOH=6.9			2 HOH=7.0	
	% CO2? 9.5300 RUN			₹ C02?	
	2 OXYGEN? 9.4389 RUN			4.4388 2 DXYGEN?	RUH
X	2 CB ?			15.1099 2 CG ?	RUN
2	MW-1 =29.90				RUN
1772200 (1873200 )	MH WET=29.00-			MHd =29.31 MH WET=28.52	
કે. ક	SQRT PSTS ? 5.6768 RUN			SORT PSTS ?	
Š	TIME MIN ? 60.0000 RUN		CFX	11.5195	RUH
<b>S</b>	MOZZLE DIA ?	XROH THAS		TIME MIN ? 69.8888	PUN
2	STK BIR INCH ?	RUN HUMBER -84-SC-RT		NOZZLE DIA ?	RUN
8			PUN	STK DIA INCH ? 60.0000	RUN
	• VOL MTR STD = 38.228 STK PRES ABS = 30.34	VOL MTR STD ? 46.65	RUN	* VOL HTR STD = 46.65	
¢	VOL HOH GAS = 2.84 2 MOISTURE = 6.92	STACK DSCFM ? 28,313.00	RUN	STK PRES R9S = 39.1 VOL HOH GRS = 3.54	14
	NOL BRY CAS = 0.931 % NITROGEN = 81.04	FRONT 1/2 MG ?		2 HOISTURE = 7.85 HOL DRY GAS = 8,936	3
	<b>MOL NT BRY = 29.98</b> <b>MOL NT NET = 29.0</b> 8	176.39 BACK 1/2 MG ?	RUN	% NITROGEN = 80.47 MOL NT BPY = 29.31	-
	VELOCITY FPS = 13.73 STACK AREA = 23.76		RUN	MOL NT NET = 28,52 VELOCITY FPS = 28.2	12
£	STACK ACFH = 19,565. • STACK DSCFH = 11,063.	F GR/DSCF = 0.06		STACK AREA = 19.63 STACK ACFM = 33,242	-
	2 ISOKINETIC = 101.16	F NG/HMH = 133.46 F LB/HP = 14.15		• STACK DSCFM = 28,31	3.
\$	FND OF FIELD DATA	F KG/HP = 6.42		I ISOKINETIC = 100	•91
	THE PERSON NAMED IN COLUMN			THE AC ETC! 8 8444	
<b>E</b> *					
<b>2</b>					
<b>X</b>					
8					
<b>I</b> X					
		155			
0 ************************************	መስታ ሲዲፎዊ ሲል ተልተው ነው። መስ	ייני. אבר אבר זער אבר אנד זעיף זער זער זער אנד אוני	መስ የመስጥል የመስጥል የመ	و المراجع المر	** ** **
<u>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</u>			<u> </u>		

XROHW	: <u>-</u>				
RUN HUMBER				RUH NUMBER	711-3-
	RUN			-B4-SE-R3	
METER BOX Y? 1.0820	RUN	XROH =NOS	CELO.	METER BOX Y?	RUN
DELTA H? 2.3090	RUN	RUH HUMBER		1.8820 BELTA H?	RUH
BAR PRESS ? 30.1300	RUN	B+-SC-B2	RUN	2.42 <del>00</del> Bar Press ?	PUN .
METER VOL ? 42.4720	RUH	VOL HTR STD ?		30.1300 METER VOL ?	RUH
MTR TEMP F? 67.4899	RUN	46.583 STACK DSCFM ?	RUN	43.7620 HTR TEMP F?	RUH
STATIC HOH IN ?	RUN	28,289. <del>80</del> Front 1/2 Mg ?	RUN	70.5599 Static Hom in ?	RUN
STACK TEMP. 119.8500	RUN	217.79 BACK 1/2 MG ?	RUN	.1600 STACK TEMP.	RUN
ML. WATER ? 82.7400	RUN		RUN	124.8500 ML. WATER ?	RUN
•		F GR/DSCF = 0.97		93.5990	RUM
SAT % = 11.4		F MG/MMM = 165.04 F LB/HR = 17.44 F KG/HR = 7.91		SAT 2 = 12.7	
IMP. 2 HOH = 7.7				IMP. 2 HOH = 8.4	
% HOH=7.7				% HOH=8.4	
\$ C02?					
4.5789 2 OXYGEN?	Bûn			% CO2? 4.5399	RUN
15.6300 2 CO ?	RUN			Z OXYGEH? 15.58 <del>98</del>	RUN
400	RUN			\$ CO ?	RUN
MWd =29.36					
MW WET=28.48				MHJ =29.34 MH NET=28.39	
SORT PSTS ?					
11.5409 TIME MIN ?	PUH			SQRT PSTS ? 11.8879	RUN
60.09 <del>99</del>	RUN	XROH THAT	SSFER -	TIME MIH ? 60.000	RUN
.3130 STK DIA INCH ?	RU4	RUH HUHBER B4-S <del>C-R3</del>		NOZZLE DIA ?	RUN
69.9999	RUN		RUN	STK DIA INCH ? 60.8980	RUN
. VOL MTR STD = 46.5	33	VOL MTR STD ?			
STK PRES ABS = 39. VOL HOH GAS = 3.89		47.734 STACK DSCFN ?	RUN	* VOL MTR STB = 47.7 STK PRES ABS = 30.	
% MOISTURE = 7.72 MOL DRY GAS = 0.92	23	28,668.80 FRONT 1/2 MG ?	RUH	<b>VOL HOH GAS = 4.41</b> <b>2 HOISTURE = 8.45</b>	
% HITROGEN = 79.88 MOL NT DRY = 29.36	•	41.68 BACK 1/2 MG ?	RUH	HOL DRY GRS = 0.91 ≵ HITROGEN = 79.97	
MOL NT NET = 28.48 VELOCITY FPS = 28.	1		RUN	MOL NT DRY = 29.34 MOL NT NET = 29.39	)
STACK AREA = 19.63				VELOCITY FPS = 29.	
STACK ACFM = 33,32		F GR/DSCF = 0.01		STACK APEA = 19.63	
* STACK DSCFM = 28.2		F MG/MMM = 30.78 F LB/HP = 3.30		STACK ACFM = 34,39 * STACK DSCFM = 28,6	
2 ISOKINETIC = 10	11 EU	F KG/HP = 1.50		\$ ISOKINETIC = 18	

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FND OF FIELD DATA

APPENDIX J

Calibration Data

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# METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 280ct 87 Meter box number Tilled Barometric pressure,  $P_b = 21.575$  in. Hg Calibrated by Dale Gas volume Temperature Dry gas meter Orifice Wet test Dry gas Wet test Outlet meter meter meter Inlet Time manometer (V_U),  $(v_d)$ , (t_{d.}), (t_d),  $(t_d),$ (Θ), setting  $(\Delta H)$ ,  $ft^3$  $ft^3$ VAC- in. H20 ٥F min 4.672 1.072 5 0.5 2.0%-533.5 5 4.684 1.0 2.096 9.376 34 533,5 1.5 10 2.66 9.40073 2.0 10 533 533 3.0 10 ŀ.

533.5

4.0

b

10

 $\Delta H$ , ΔН in. H20 0.0368 0.5 0.0737 1.0 1.5 0.110 0.147 2.0 3.0 0.221 4.0 0.294

Quality Assurance Handbook M4-2.3A (front side)

 $^{^{\}rm a}$  If there is only one thermometer on the dry gas meter, record the temperature under  $t_{\rm d}$ .

POSTTEGT DBY GAS METER CALIBRATION DATA FORM (English units)

Plant (4755,000)	Protest Y / CBB	Υ.	<b>-</b>	V P. (t. + 460)	D C 3	V3 (P, + AH )/t. + 460	13.6/1	3-	8	16
Plan	Prote				<i>&gt;</i> -	-		1.673.	1.0789	16.01
which	nutial				Vacuum	setting,	in. Hg	16		
1/1					Гіте	·(Θ)	นเพ	14 36 Pl	13.60	14 3/4°C
ex number	in. Hg Dry gas meter number		eter	Average	(t,),"	- i	•	3% H J45/ 08	8. 4541.5	82.5/542/14 3/c 21
hate 2410087 Meter box number	Dry gas m	ature	Dry gas meter	er Inlet Outlet Average	$ (t_{3}), (t_{3}), (t_{3}), $	C	o F	27.	2.2	
Jan 8-	n. Hg	Temperature		ln]	(t)		oF.	ري ميردنم دريم	530	537.0 85 80
17. 241	30.34		Wet test	meter	(:);	<b>₹</b> 1±		3. 3. 3.	12 536.5 35	77 537
) Da	ع		Dry gan	meter	· ( ', ', ', ', ', ', ', ', ', ', ', ', ',			3 38 139 76 53 0 35	1X 5 5 5 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	51.23 2.34
Test number	Barometric pressure, 1	Gas volume	Wet test	meter	('.')	· ±		01	10	10
Test	Ear on	Oritice	manometer	setting,	(.NE),	in. H ₂ 0		3	5	4

 $^{
m a}$  if there is only one thermometer on the dry gas meter, record the temperature under t $_{
m d}$ 

 $V_{\rm w} = {\rm Gas\ volume\ passing\ through\ the\ wet\ test\ meter,\ ft}^3$ 

 $v_{\rm d}$  = Gas volume passing through the dry gas meter, ft³.

 $t_{\rm w}$  = Temperature of the gas in the wet test meter, °F.

 $d_{i}$  = Temperature of the inlet gas of the dry gas meter,  $^{o}F$ .

 $t_d^{-}$  = Temperature of the outlet gas of the dry gas meter,  $^{
m oF}.$ 

 $t_d$  = Average temperature of the gas in the dry gas meter, obtained by the average of  $t_d$  and  $t_d$  , °F.  $\Delta H$  = Pressure differential across orifice, in.  $\rm H_2O$ .

 $Y_{\rm i} = Ratio | {
m of} | {
m accuracy} | {
m of} | {
m wether} | {
m test}|$  meter for each run.

= Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y  $\pm 0.05$ Y.

, = Barometric pressure, in. Hg.

 $\theta$  = Time of calibration run, min.

Quality Assurance Handbook M4-2.4A

## NOZZLE CALIBRATION DATA FORM

Date See Below Calibrated by Mitaly							
Nozzle identification number		D ₂ , mm (in.)		ΔD, b mm (in.)	D avg		
Scrubber stack. Boiler 3 + 4 d= .325	0,313	c.3/3	c, 313	0.000	0.3/3		
Bypass stack Bollin 3+4 of 20,500	Į.	Į .			0.498		

where:

b  $\Delta D = \text{maximum difference between any two diameters, mm (in.),} \Delta D \leq (0.10 \text{ mm}) 0.004 \text{ in.}$ 

 $D_{avg} = average of D_1, D_2, and D_3.$ 

Quality Assurance Handbook M5-2.6

# ANALYTICAL BALANCE CALIBRATION FORM

Balan	Balance name		See Below		Number		
Class	ification	of standar	d weights _	Class S weights			
Date	0.500 g	1.0000 g	10.0000 g	50.0000 g	100.0000 g	Analyst	
Mettler PT 1200 9 Nov 87 Triple Beam 19 Nov 20 Nov 22 Nov	0,47 Balunce- 0.5 0.375	0.97	9,97 10,00 10,00 10,00	49,98	99.97 100.00 100.00 100.02	AND SID	
Mettler RE163 10 Nov87 10 Nov87 28 Sic 29 Dec 30 Dec 1 Jin 88	0.4999 C.5000	1.0000 1.0001 1.0000 1.0000 1.0000 0.9999	10.0002 10.0003 9.9996 9.9996	50.0009 49.9981 49.9981	100.0017 99.9964 99.9965	See	

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